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THE PROVOCATIVE TESTS IN THE DIAGNOSIS OF THE GLAUCOMAS*

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The importance of establishing the diagnosis in the early glaucomas has led to a long list of so-called provocative tests for these conditions. These tests attempt to cause an abnormal elevation of intraocular pressure as evidence of a disturbance in the regulatory mechanism of this pressure. However, with the increasing realization that we are dealing with several glaucomas rather than with a single disease entity, and because the provocative tests are generally considered unreliable,[1] an evaluation of several of these tests was undertaken in normal and glaucomatous eyes.

The various tests were made on the same group of glaucomatous patients so as to compare not only the test results with normal eyes, but also to compare the results of the various tests in the same glaucomatous eyes. As a consequence of these studies a further provocative test combination is presented which has given greater elevations of intraocular pressure than previously used tests.

The tests to be considered are the so-called water test, the caffeine test, the pupillary dilatation or mydriatic test, the combined cold-pressor and jugular compression test (the lability test), and a combination of the latter with the water test. These tests will be considered in the above order and then compared. All tonometric readings were made with a new Schiøtz tonometer, certified at the Chicago testing station, and are in terms of millimeters of mercury.

THE WATER TEST

The drinking test or water test was introduced by Schmidt[2] in 1928 following the studies of Marx[3] on the changes in the blood produced by drinking a liter of water.

METHOD

As the test is generally done, the patient drinks a liter of water before breakfast. Tonometric measurements are made every 15 minutes. In glaucomatous patients the tension is said to increase from 6 to 15 mm. Hg (Schiøtz) in about half an hour. In my own studies each test was done at least two hours after breakfast. Each patient was asked to drink a liter of water within a period of five minutes. The readings were made at one-half hour and again at one hour following the water ingestion.

RESULTS

In 143 normal eyes of adults from 18 to 70 years of age, the average rise of intraocular pressure was 1.9 mm. Hg (ranging from −2 to +9 mm.) at one-half hour. At the one-hour reading the intraocular pressure decreased an average of 0.5 mm. (ranging from −2 to +13 mm.) from the half-hour reading.

In 17 eyes the one-hour reading was higher than the half-hour reading, while it decreased in the remaining 126. In the same group of 143 normal eyes, the tonometric tension rose from 23 to 27 mm. to 30 mm. in

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TABLE 1

RESULTS OF THE WATER TEST IN GLAUCOMATOUS EYES

(The figures in parentheses indicate the range of change)

Initial Tension (mm. Hg [Schiøtz])	Simple Glaucoma											
	Unoperated Eyes						Operated Eyes					
	Without Miotics			Following Pilocarpine			Without Miotics			Following Pilocarpine		
	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension
		mm.	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*
10–14	—	—	—	—	—	—	3	+2.3 (+2 to +3)	0	—	—	—
15–24	9	+2.9 (−3 to +8)	−0.4 (−3 to +3)	15	+4.4 (+2 to +9)	−1.6 (−5 to +1)	5	+6.0 (+2 to +9)	−1.8 (−3 to +1)	4	+6.0 (+3 to +13)	+0.7 (0 to +3)
25–29	50	+5.9 (−2 to +20)	−2.1 (−11 to +4)	40	+4.6 (−2 to +11)	−2.1 (−5 to +1)				4	+5.2 (+2 to +8)	−3.0 (−8 to +2)
30–34	27	+5.4 (−5 to +18)	−1.1 (−15 to +7)	20	+5.3 (−1 to +12)	−0.9 (−12 to +6)				3	+6.3 (+4 to +9)	−4.3 (−6 to −2)
35–39	19	+8.7 (0 to +20)	−0.1 (−10 to +20)	7	+6.1 (0 to +12)	−3.0 (−7 to +5)						
40–44	7	+8.8 (0 to +23)	+0.3 (+8 to +12)	5	+6.6 (0 to +15)	+2.6 (−7 to +10)						

Initial Tension (mm. Hg [Schiøtz])	Unoperated Narrow-Angle Glaucoma						Posterior Lens Dislocation						Postcataract Glaucoma					
	Without Miotics			Following Pilocarpine			Without Miotics			Following Pilocarpine			Without Miotics			Following Pilocarpine		
	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension	No. cases	½ hr. tension	1 hr. tension
		mm.	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*
10–14																		
15–24	3	+4.6 (+2 to +9)	0 (−1 to +1)	3	+7.3 (+5 to +11)	+2.0 (−2 to +6)												
25–29	—	—	—	2	+1.5 (0 to +3)	−1.0 (−2 to 0)	1	+11	+2							1	+20	−4.0
30–34	2	+5.5 (+2 to +9)	+1.0 (0 to +2)	—	—	—	1	+16	−2	1	+8	+6						
35–39													1	+10	−6			
40–44													1	+10	−8			

6 eyes, to 31 mm. in 1, and to 32 mm. in 2.

In all instances where the tension in normal eyes rose to 30 mm. or above, both in this group and those normals to be discussed, the patients were asked to return for visual-field studies and a review of the tonometry and ophthalmoscopy. Two thirds of them were studied in this way and no evidence of glaucoma was found. Many of these and of those who did not return were in the age group between 18 and 35 years. Glaucoma simplex in such a proportion of unselected normals is not to be expected. The significance of these readings of 30 to 32 mm. will be considered in a later section of this paper.

The water tests on glaucomatous eyes were done both without miotics and following the use of pilocarpine in operated and unoperated eyes. The results are shown in Table 1.

Control study

A control study was made on the same general group of glaucomatous eyes. Sixty-one were unoperated eyes with simple glaucoma. They were divided into two groups, the first consisting of 56 eyes with an initial tension under 40 mm. Hg and 5 with 40 mm. or over.

Those with an initial tension under 40 mm. showed an average decrease of 0.7 mm. after one-half hour, and an additional average decrease of 0.4 mm. during the second half hour. The range of change was −7 to +5 mm. In the 5 eyes with an initial tension of 40 mm. or higher, there was an average increase of 1 mm. after one-half hour and an average of zero change during the second half hour. The range of change was −8 to +12 mm.

Fourteen operated eyes with simple glaucoma were observed as controls. There was no significant relation between the initial pressure and the change after one-half hour and after one hour. At the half-hour reading these eyes showed an average decrease of 0.7 mm. During the second half hour a further average decrease of 0.7 mm. occurred.

Controls on 4 quiescent narrow-angle-glaucoma eyes showed an average increase of 1.7 mm. at the half-hour reading, with no change during the second half hour.

In 3 eyes with glaucoma seondary to posterior lens dislocation, the control readings showed an average increase of 3 mm. at one-half hour (range −2 to +7 mm.), followed by an average decrease of 1.3 mm. during the second half hour (range −5 to +2 mm.).

Comments

In the normal series reported above, the provocative effect of the water test averaged only 1.9 mm. in the first half hour but individual instances showed up to 9 mm. of increase, which is higher than many of the provocative results in the glaucomatous eyes. Thus, it is impossible to draw a sharp line separating the normal from the glaucomatous in every instance. Arbitrarily, one might say that an increase in intraocular pressure of over 9 mm. at the half-hour reading may be considered a positive water test. A negative test would not indicate the absence of potential glaucoma in the broad definition of this term, nor does a positive test prove its presence with certainty.

The average one-hour readings of this test, when compared to the half-hour readings, show a general decrease of intraocular pressure. However, in 18 of the 112 (16 percent) unoperated eyes with simple glaucoma in which the test was performed without the previous use of miotics, and in 12 of the 87 (13 percent) following the use of pilocarpine, there was an increase in the intraocular pressure during the second half hour. This indicates the necessity of doing the one-hour reading, at least when the rise during the first half hour indicates a negative response.

A separation of the results of the water test in unoperated eyes of patients with simple glaucoma according to the initial tension readings indicates that the average ele-

vation of intraocular pressure following the ingestion of a liter of water depends to some extent on the level of the initial pressure. With increasing levels of initial tension, there is proportionately a greater increase in the pressure increment as is shown in Figure 1. The same is true when the tests are done in the same group of eyes following

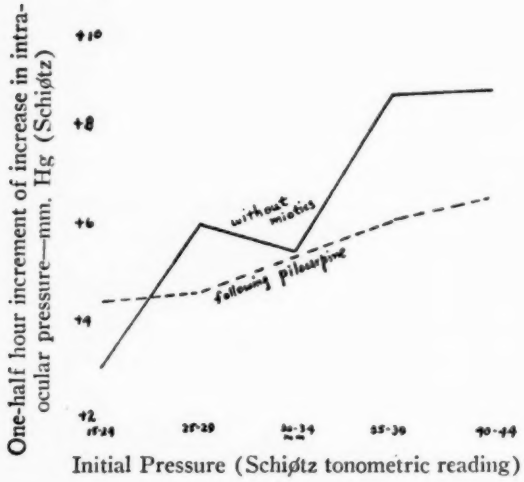

Fig. 1 (Sugar). The relation between the initial pressure and the increments of pressure increase at the half-hour readings of the water test in eyes with unoperated simple glaucoma.

the use of pilocarpine, although the increment of pressure rise is somewhat less (fig. 1).

Although the tested group of operated eyes with simple glaucoma and of eyes with the other glaucomas was too small for conclusions to be drawn, the water test caused a significant increase in intraocular pressure in some of them, in spite of an increase in the controls in the eyes with narrow-angle glaucoma and with glaucoma secondary to posterior lens dislocation. One should, therefore, be careful in using the water test as one of the differential criteria in separating the various glaucomas. It is probable that positive results with this test are not confined to eyes with simple glaucoma.

In the small number of successfully operated cases with well-filtering blebs, there was no significant difference in the rise in pressure produced by the water test in these eyes as compared to the tests on unoperated eyes with normal initial pressures. This suggests that the increase in pressure is too rapid to allow the blebs effectively to prevent it. It is evidence that the concept that these operations control but do not cure the glaucomatous process is correct.

The caffeine test

Lohlein[4] introduced this test which was originally carried out by giving an intravenous injection of 0.2 gm. of caffeine. Later, the test was carried out by having the patient drink 150 cc. of water containing 45 gm. of coffee. In the glaucomatous eye there is said to be a rise of up to 15 to 25 mm. Hg (Schiøtz) in 20 to 40 minutes. The use of black coffee has the disadvantage for investigative purposes that it introduces to some extent the factor of fluid volume involved in the water test.

Thirty-two unoperated eyes with simple glaucoma were studied using 0.5 gm. of caffeine sodium benzoate intramuscularly. The intraocular pressure was measured after a half hour, and again after one hour. All had initial tensions of less than 40 mm. Hg (Schiøtz). Twenty subjects were coffee drinkers while the remaining 12 used no coffee or tea. The coffee drinkers showed an average rise of 2.1 mm. (range —2 to +6 mm.) one-half hour after the caffeine injection and a subsequent average decrease of 0.1 mm. during the second half hour (range −9 to +7). The nonusers of caffeine-containing beverages showed an average decrease of 0.1 mm. at the half-hour reading (range −6 to +8 mm.) and a subsequent average rise of 0.5 mm. during the second half hour (range −6 to +3 mm.). These results did not indicate sufficient value to continue the investigation of caffeine by intramuscular injection as a provocative test.

The mydriasis test

The mydriasis test for glaucoma was used by Jackson[5] in the form of 2-percent cocaine, and with 2-percent euphthalmine by Gradle.[6] The tonometric readings were taken 90 to 120 minutes after the instillation. An increase of 7 mm. Hg or more (Schiøtz) was considered as evidence of a pathologic condition.

When the pupil is dilated there is an increase in the anteroposterior thickness of the iris at its root. In eyes with narrow angles, this leads to further narrowing of the entrance to the angle and may lead to partial or complete obstruction with resultant increased intraocular pressure. When the latter occurs, a definite relationship is found to exist between the chamber angle depth, the pupil size, and the thickness of the iris root.

In gonioscopic studies[7] of the effect of various mydriatic drugs on the fellow eyes of patients with unilateral acute glaucoma and on eyes which had suffered an acute episode but had become normal following the use of miotics, it was found that in each of the cases in which mydriasis caused an increase in intraocular pressure, the angle was open before pupillary dilatation, but closed by the iris at the end of dilatation. In the negative cases, the angle entrance remained open, although narrowed. The provocative dilatations were done with 2-percent euphthalmine, with 1-percent paredrine, or with 2-percent homatropine, and gave positive results in 7 of 20 eyes.

Method

In the present study, the pupils of 51 unoperated eyes with simple glaucoma were dilated with 4-percent homatropine hydrobromide, and the pupils of 49 eyes, nearly all of them the fellow eyes of those dilated with homatropine, were dilated with 10-percent neosynephrine. The initial tonometric readings were under 40 mm. Hg Schiøtz in these cases. No miotics had been used on the morning of the test. The tension observations and pupillary measurements were made a half hour and one hour after the instillations.

Results

The average rise in intraocular pressure in the homatropine group after a half hour was 0.5 mm. Hg (range −4 to +8 mm.), with another 0.5 mm. increase during the second half hour (range −4 to +6). In the eyes in which neosynephrine was instilled, there was an average fall of 1.7 mm. during the first half hour (range −8 to +7 mm.), with an average recovery of 0.2 mm. during the second half hour (range −6 to +8). The pupils dilated on the average 1 to 2 mm. more with neosynephrine than with homatropine but dilated well. There was no instance of an increase of intraocular pressure of over 8 mm. in any case of simple glaucoma. No instance of congestive reaction occurred even though the patients were permitted to leave the clinic while the pupils were still dilated.

In contrast to the above findings were the results in 7 quiescent eyes which had either had acute glaucomatous attacks with congestion previously or were the fellows of such eyes. The pupils of the remaining 3 were dilated with 10-percent neosynephrine. In one eye of the homatropine group neosynephrine was later used for the mydriasis test.

Of the 4 homatropinized eyes, 2 showed no rise in tension, while 2 showed significant increase, one from 29 to 70 mm. Hg in one-half hour; the second, from 25 to 41 mm. Hg in one hour. Of the eyes in which neosynephrin was used, 2 showed no rise in pressure, and 2 showed significant increase, one from 38 to 70 mm. Hg in one-half hour, and the second showed no rise during the first 5 hours but during the 6th hour tension rose from 22 to 51 mm.

Comment

In 1941, as the result of the previously mentioned gonioscopic studies, I pointed out[8] that the provocative tests for glaucoma may be divided into two groups, one group for eyes with normal anterior-chamber depth, including the caffeine test, the water test, and anterior-chamber puncture in the order named (these tests no longer have the same significance, as indicated elsewhere in the paper), and a second group with shallow chambers and narrow angles for which the mydriatic tests were indicated.

It appeared then, as it does now, that as a provocative test pupillary dilatation can be of various degrees, from mere discontinuance of miotic medication in a controlled narrow-angle glaucoma patient with very shallow chambers, to the next degree—the darkroom test, and then the use of weaker and then stronger mydriatic drugs. Only when adequate pupillary dilatation has been obtained is the mydriatic test of any value.

Additional factors should be considered. The first is the time factor which is required for dilatation and the building up of tension. In my experience, once the angle is blocked, the pressure rises within 20 to 30 minutes to high levels. Patients provoked with mydriatic drugs should be observed for about 4 to 5 hours before considering the test negative. There should be no hesitancy in using any of the mydriatic drugs except scopolamine and atropine for these tests, since the other mydriatics can be counteracted without too much difficulty.

Another factor in using mydriatic drugs is that some of the drugs, especially the spastic mydriatics, are also vasoconstrictors. The latter action tends to thin the iris while it dilates, so that these drugs require greater dilatation to get angle blockage than do drugs like homatropine.

The findings of the present study reiterate the lack of danger of mydriasis in simple glaucoma, and its danger in narrow-angle glaucoma. No mydriatic is free of danger in preacute glaucomatous eyes.

The pressor-congestion test

The pressor-congestion test, the so-called lability test of Bloomfield and Lambert,[9] was presented by these two investigators in 1945. It was based on a combination of the cold pressor test of Hines and Brown[10] which is a vasopressor reaction of probable neurogenic origin and the jugular compression test of Wessely and Schoenberg.[11]

Method

The pressor-congestion test is performed in the following manner: An initial tonometric reading is made with the patient lying supine. A sphygmomanometer cuff is placed loosely about his neck with the rubber portion anteriorly, over the jugulars. One of the patient's hands is immersed to the wrists in chipped ice and water and the cervical cuff inflated to between 50 and 60 mm. of mercury for one minute. A tonometric reading is then made and the hand removed from the ice water, and the cervical cuff deflated. The tension returns to the level of the initial reading almost immediately.

In the pressor-congestion tests made in this study the rubber portion of the cuff was folded and taped in this position to make it narrower before applying it to the neck.

Results

In 192 normal eyes, this test gave an average increase of 3.6 mm. Hg (Schiøtz) (range −2 to +9 mm.). Only 6 showed a decrease of up to 2 mm. Of the 192 eyes, 39 (20.3 percent) showed a rise of intraocular pressure from an initial reading of 23 to 28 mm. to up to 33 mm. as follows: 18 increased to 30 mm., 5 to 31 mm., 9 to 32 mm., and 7 to 33 mm.

The pressor-congestion test was performed in 112 unoperated eyes with simple

glaucoma and 13 operated ones as well as in 4 unoperated eyes with narrow angles and a history of previous acute glaucoma. The results are shown in Table 2.

Comments

According to Bloomfield and Lambert,[9] the most important factors in determining the intraocular pressure at any time are the variations in the volume of the intraocular fluids. This volume depends on the blood flow, so the transient vascular congestion induced by the pressor-congestion test tends to produce an increase in intraocular pressure which is particularly evident when the mechanisms controlling the intraocular pressure are defective.

There is one mechanism which has not been considered by Bloomfield and Lambert in the transient rise of intraocular pressure produced by the pressor-congestion test. This is the effect on the extraocular musculature. Any test such as the one under consideration, whereby the tonus of the extraocular muscles as well as the tonus of all the voluntary muscles is increased, would cause an increase in intraocular pressure. I am under the impression that those patients who are most tense under the conditions of the test have a greater increase in intraocular pressure.

Bloomfield and Lambert claimed that if this procedure produced a rise in ocular tension of over 9 mm. the diagnosis of chronic simple glaucoma was strongly suggested and, if the height to which the tension rose in the tested eye exceeded the normal limit of 30 mm., whether or not the actual rise in tension was more than 9 mm., such a diagnosis was even more conclusively indicated. In the glaucomatous eyes of my series the rise of intraocular pressure from application of the pressor-congestion test did not exceed the 9 mm. level mentioned by Bloomfield and Lambert in even half of the cases.

In the normal series of eyes, the occurrence of an increase of intraocular pressure to 30 mm. or above in 20 percent of the eyes does not agree with the second portion of the above claim.

Four patients of the normals who showed an increase in tension to 30 mm. or above with the pressor-congestion test were subjected to anterior-chamber puncture. All gave responses which I consider normal. The results are shown in Table 3. In each case there was no evidence of leakage from the puncture wound as shown by the application of fluorescein. A single control puncture in an eye with definite early simple glaucoma, with an initial tension of 26 mm. and a rise to 35 mm. following the pressor-congestion test, was followed by a rise to 56 mm. at the 2-hour reading, a definitely glaucomatous response.

The anterior-chamber puncture test[12] in

TABLE 2

Results of pressor-congestion tests in glaucomatous eyes

Initial Tension (mm. Hg [Schiøtz])	Simple Glaucoma						Quiescent Narrow-Angle Glaucoma Unoperated		
	Unoperated			Operated					
	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range
		mm.	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*
15–24	12	+7.1	0 to +13	3	+ 7.0	+3 to +10	4	+2.5	0 to +9
25–29	47	+4.2	0 to + 9	4	+ 4.5	0 to +10			
30–34	38	+4.3	0 to +16	2	+11	+4, +18			
35–39	11	+2.9	0 to + 9	2	+ 3.5	+2, + 5			
40–44	4	+8.2	0 to +15	2	+ 7	+7, + 7			

TABLE 3

RESPONSE TO ANTERIOR-CHAMBER PUNCTURE IN 4 NORMAL EYES WITH INCREASED TENSION WITH THE PRESSOR-CONGESTION TEST

	Initial Tension (mm. Hg [Schiøtz])	Tension After Test	Response to Anterior Chamber Puncture (Maximum Tension)
1.	25 mm.	30 mm.	36 mm.
2.	23 mm.	32 mm.	28 mm.
3.	26 mm.	32 mm.	32 mm.
4.	28 mm.	32 mm.	33 mm.

my experience is an excellent test for simple glaucoma and one which is useful in investigative work, although in office practice and even in the clinic rarely is indicated. It is not without danger, and should not be repeated too often with total evacuation of the aqueous as it may lead to stretching of the zonule.

In this test a normal response may be considered to be anywhere in the low 30's. I see no reason why a provocative rise in intraocular pressure to 30 mm. or above in normal eyes may not occur with the water and pressor-congestion tests as it does in the chamber puncture test.

THE WATER AND PRESSOR-CONGESTION TEST

METHOD

In order to increase the strain on the regulatory mechanism of the ocular tension, in line with the idea of the pressor-congestion test, a combination of the water test and the pressor-congestion test was studied in 71 normal eyes and in 107 glaucomatous eyes. This test was started at least two hours after breakfast or lunch. An initial tension reading was made and the patient given a liter of water to drink within a period of about five minutes. At the end of a half hour, the pressor-congestion test was done. The difference in tension between the initial reading and that at the end of the pressor-congestion portion of the test was recorded.

RESULTS

In 71 normal eyes the average rise in intraocular pressure after this test was 5 mm. (range −3 to +10). Of these, 24 (33.8 percent) rose from a normal of 23 to 28 mm. to 30 mm. or over, as follows: 10 increased to 30 mm., 6 to 32 mm., 2 to 33 mm., 3 to 36 mm., and 3 to 38 mm.

The results of the combined test in glaucomatous eyes are shown in Table 4. They indicate a greater increase is tension with this test than in any of the previous ones. A comparison of the results of the water test, the pressor-congestion test, and the combined test shows these results more clearly. In Table 5 are shown the compared results in normal eyes and in Table 6 those in glaucomatous eyes.

Further comparison of the tests was made by doing the various tests at different times in the same eyes. In normal eyes a comparison of the water test with the pressor-

TABLE 4

RESULTS OF COMBINED WATER AND PRESSOR-CONGESTION TESTS IN GLAUCOMATOUS EYES

Initial Tension (mm. Hg [Schiøtz])	Simple Glaucoma						Narrow-Angle Glaucoma Unoperated		
	Unoperated			Operated					
	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range	No. Cases	Average Increase	Range
		mm.	*mm.*		*mm.*	*mm.*		*mm.*	*mm.*
15–24	24	+ 9.7	+2 to +29	2	+ 1.8	+10, 26	3	+9.0	+4 to +14
25–29	39	+ 8.3	+2 to +22	3	+11	+ 7 to +13			
30–34	16	+11.5	−4 to +32	3	+ 4.6	0 to +12			
35–39	8	+ 7.9	0 to +22	2	+ 6	0, +12			
40–44	5	+17	+7 to +29	2	+ 8.5	+ 7, +10			

TABLE 5

A COMPARISON OF THE WATER, PRESSOR-CONGESTION, AND COMBINED TESTS IN NORMAL EYES

	Number of Eyes	Average Increase in Tension	Range	% of Increase to 30 mm. or Above
		mm.	*mm.*	
Water test	143	½ hr. +1.9 1 hr. −0.5	−2 to + 9	6.3%
Pressor-congestion test	192	+3.6	−2 to + 9	20.3%
Combined water and pressor-congestion test	71	+5.0	−3 to +10	33.8%

congestion test was made in 38 eyes. The water test gave an average increase of 2.5 mm. in a half hour, followed by an average decrease of 0.8 mm. during the second half hour. The pressor-congestion test in these same eyes gave an average increase of 3.3 mm.

A further comparison of the water test and the combined water and pressor-congestion test was made in 27 normal eyes. In the water test, there was an average increase of 2.8 mm. in a half hour and an average decrease of 0.8 mm. during the second half hour.

The eyes on which the combined test was done had tonometric readings both before and after the pressor-congestion portion of the test. The reading after the water portion and just before the pressor-congestion portion indicated an average increase of 2.8 mm. At the end of the pressor-congestion portion it had risen an additional average of 2.2 mm., a total of 5.0 mm. for the test.

TABLE 6

A COMPARISON OF THE AVERAGE INCREASE IN TENSION PRODUCED BY THE WATER, PRESSOR-CONGESTION, AND COMBINED TESTS IN UNOPERATED SIMPLE GLAUCOMATOUS EYES

Initial Tension (mm. Hg [Schiøtz])	Water Test (no drops) ½ hr.	Pressor-congestion Test	Water and Pressor-congestion Test
	mm.	*mm.*	*mm.*
15–24	+2.9	+7.1	+ 9.7
25–29	+5.9	+4.2	+ 8.3
30–34	+5.4	+4.3	+11.5
35–39	+8.7	+2.9	+ 7.9
40–44	+8.2	+8.2	+17.0

All three tests were made at different times on the same group of 81 unoperated and 10 operated eyes with simple glaucoma. The initial tensions were under 40 mm. Hg (Schiøtz). A comparison of the results is shown in Table 7.

COMMENTS

It is apparent, in comparing the three tests, that the average tension rise is greater in the pressor-congestion test than in the water test, and highest of all in the combined test but that there is also a proportional increase in the number of normals rising to 30 mm. or above.

Since the range of tension rise in the normal eyes studied with the combined test was practically the same as with the other two tests, one would be justified in saying that an increase of over 10 mm. indicates a positive test. However, most of the glaucomatous eyes showed lesser increases than this. As with the other provocative tests, a negative result does not rule out glaucoma.

TABLE 7

A COMPARISON OF THE WATER, PRESSOR-CONGESTION, AND COMBINED TESTS IN THE SAME SERIES OF EYES WITH SIMPLE GLAUCOMA

	Average Rise in Tension in mm. Hg (Schiøtz)	
	Unoperated	Operated
Water test		
½ hr.	+5.6	+6.0
1 hr.	−2.1	−2.0
Pressor-congestion-test	+4.8	+6.5
Water and pressor-congestion test	+8.9	+8.8

Conclusions

The combined water and pressor-congestion test gives evidence of higher responses in glaucoma than do the water or pressor-congestion tests alone.

With the water test, a positive result may be considered to be a rise of over 9 mm. or a rise to over 32 mm. With the pressor-congestion test, a rise of over 9 mm. or a rise to over 33 mm. may be considered a positive result. With the combined test, a positive test may be considered to be a rise of over 10 mm. or to over 38 mm. Unless the ceilings mentioned above are used, there is danger of diagnosing glaucoma in normal eyes.

The caffeine test, as performed in this study, gives no consistent results.

Mydriasis in simple glaucoma is harmless and has not given a single significant increase in pressure. In eyes with narrow angles, it is the best available provocative test but is dangerous if not adequately followed by miotics. Although the vasoconstricting spastic mydriatics are relatively less dangerous than the others, they do cause angle blockage in some cases. No mydriatic is without danger in such eyes.

No provocative test is of greater diagnostic value than the practice of routine and repeated tonometry in all patients 40 years of age or older, especially in early simple glaucoma where no field changes have occurred, and where the tension is at the borderline of normal. In a minority of instances these tests will give some aid in diagnosis.

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THE PRESSOR TEST FOR GLAUCOMA*

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This study was undertaken in an attempt to confirm the lability pressor test for chronic simple glaucoma described by Bloomfield and Lambert.[4] The test was found to be not only quick and easy to perform, but was without question the most reliable test yet proposed for the diagnosis of one type of glaucoma. It was, however, found to be distinctly unreliable in another type of glaucoma.

THE PRESSOR TEST

Probably the most potent factor determining the intraocular pressure at any given time is the distensible vascular network of the globe. This vascular bed is under both nervous and hormonal control the same as any other vascular bed in the body. While the eye's capillary bed is not the sole regulatory mechanism of the intraocular pressure, it is probably the one subject to the most variations from time to time.

Although it is obvious that there are many other factors present in the control of intraocular pressure, the pressor test attempts to utilize the vascular variations within the semirigid coat of the globe to detect the presence of abnormal variations in the intraocular pressure.

As many authors have stated, the increased lability of the intraocular pressure is one of the most reliable signs of incipient glaucoma, and the test herein described is a method whereby a sudden strain is thrown on the regulatory mechanism of the eye so that increased lability will be made clinically appreciable.

Bloomfield and Lambert[4] state that, "The idea of a test to indicate the increased lability of [the intraocular pressure] is not new. In cases of diabetes mellitus and of vascular hypertension, for example, evidence of an increased lability in the regulation of levels of the blood sugar and the blood pressure, as indicated by the dextrose tolerance and the cold pressor test respectively, is considered a valuable indication of impending morbidity. The basic idea in such tests is to throw a sudden strain on [the control system] by means of a standardized stimulus and to record quantitatively the degree of deviation that occurs and the time necessary for the restoration of the physiologic norm."

With this idea in mind Bloomfield and Lambert[4] attempted to find some method whereby the flow of blood into the eye could be increased and the outflow decreased, thereby throwing a sudden strain upon the regulatory mechanism of the eye.

Hines and Brown,[6] in 1933 and 1936, described their cold pressor test, whereby sudden elevations of blood pressure, ranging from 10 mm. Hg rise in diastolic and systolic pressures up to approximately 40 mm. Hg rise in both diastolic and systolic pressures, could be obtained by the immersion of some part of the body in ice water. The amount of the rise was dependent up the vascular lability of the patient, *but there was some degree of rise found constantly in all persons!*

Wessely, Schultz, Thiel, and Schoenberg all wrote of the effects of venous congestion upon the intraocular pressure. Therefore, following the Schoenberg line of thinking, Bloomfield and Lambert used a blood-pressure cuff, applied so as to make jugular compression, in order to interfere with the drainage of fluid from the eye. By combining the cold pressor test with jugular compression, they then had a means whereby the flow of blood into the eye could be increased and at the same time the flow of blood out of the eye decreased. This forms the basis of the pressor test. For a complete history and background of the test the reader is referred

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to the excellent descriptions by the original authors.[4]

Technique

The technique used in this test is briefly as follows: The patient is seated in a reclining treatment chair at about 30 degrees from the horizontal. A sphygmomanometer cuff is loosely applied to the neck so that the balloon is in front making pressure on the jugular veins. Pontocaine (½ percent) is instilled into the eyes and the tension measured with a regular Schiøtz tonometer. The patient is then fully instructed as to the procedure of the test. Following this, the hand and wrist of the patient are immersed in water that has previously been cooled to a temperature of approximately 4°C. Simultaneously, the sphygmomanometer cuff is inflated to a pressure of 50 to 60 mm. Hg and held there during the period of the test. At the end of one minute the ocular tension is taken while the patient still has his hand in ice water and the cervical compression is maintained. The ice water is then removed and the cuff deflated.

Subjects

For the purpose of this study, the patients selected were divided into two groups. One group, in so far as it was possible to determine, had no indications of abnormal intraocular pressure, while the other group consisted of patients with proven cases of glaucoma.

The patients in the latter group all had classical findings of glaucoma; that is, cupping of the discs, increased intraocular pressure measured on numerous occasions, and field changes compatible with glaucoma. Most of them had had other types of provocative tests as well. An attempt was made to exclude all inflammatory or postinflammatory types of glaucoma.

Early in the study no attempt was made to separate the wide-angle from the narrow-angle types of glaucoma, but it was soon noted that *there was a difference in the response to the test of these two types,* and so the two were separated. An attempt was made to find and test narrow-angle types of glaucoma for the purpose of this series and so the distribution of the wide-angle and narrow-angle types is not that normally found in a group of glaucomatous patients selected at random.

The "normal" group was made up of 35 eyes (19 patients), while the "glaucomatous" group was made up of 44 eyes (24 patients). The ages ranged from 21 to 82 years with a mean of 59.5 years for the normal group, and 62.7 years for the glaucomatous group. There were 14 males and 21 females in the normal group, and 16 males and 39 females in the glaucomatous group.

Results

The results of testing these groups revealed that first of all the test is highly dependable for the detection of early chronic simple glaucoma of the wide-angle type. However, several pitfalls were revealed that must be taken into consideration in the routine use of the test.

A statistical study of the results by the method of the analysis of variance revealed that the possibility of their being obtained by chance was less than one in a thousand ($p = .001$), which means that the results are highly significant.

It will be noted in Table 1 that the mean rise in pressure with the pressor test in the normal group was 1.94 mm. Hg. This may be compared with the mean rise in the intraocular pressure of 13.82 mm. Hg in the group of wide-angle glaucoma. The mean rise of intraocular pressure with the pressor test of the narrow-angle group of glaucoma was only 2.9 mm. Hg.

When the method of analysis of variance is applied to only these two selected groups, that is, the narrow-angle group versus the normal group, p is greater than .05. This means that such a small difference could easily have arisen on the basis of chance, and, therefore, the nil hypothesis—that there

is no difference between the means other than that due to sampling variation—would have to be considered true in so far as these groups are concerned. Some of the reasons for this variation will be discussed later. The fact that the pressor test reveals no significant rise in patients with narrow-angle glaucoma means that such cases *could not be detected with this test alone!*

Another very important consideration of any test is its validity. Here again, the pressor test stands up very well, in fact far above the results of other tests, with the possible exception of the water-drinking test of Marx. Bloomfield and Kellerman[3] used the pressor test in 34 known cases of glaucoma and had 31 positives and 3 doubtfuls. Inasmuch as they apparently did not correlate their results with the gonioscopic findings, this small percentage of missed cases may well represent narrow-angle cases. In the present series of 35 known wide-angle glaucomatous eyes the pressor test was positive in every case (table 1).

It should be noted here that the criteria used for a positive test were: (1) a rise of greater than 9 mm. Hg and/or (2) a rise to a ceiling level of more than 30 mm. Hg.

TABLE 1

SHOWING THE EFFECT OF THE PRESSOR TEST UPON THE INTRAOCULAR PRESSURE IN WIDE-ANGLE GLAUCOMA, NARROW-ANGLE GLAUCOMA, AND NORMAL EYES

Wide-Angle Glaucoma			Narrow-Angle Glaucoma			Normal		
Case No.	Initial Pressure	Final Pressure	Case No.	Initial Pressure	Final Pressure	Case No.	Initial Pressure	Final Pressure
4	27	38	1	35	35	25	13	19
7	22	34	24	15	15	26	11	15
8	19	35	5	17	22	27	13	13
9	30	40	6	15	22	28	10	13
10	40	56	11	22	29	29	17	19
21	17	39	13	17	19	30	13	15
22	22	35	14	17	17	31	17	19
43	17	35	15	22	29	32	19	22
44	15	29	16	22	29	33	15	15
45	15	40	17	17	22	34	15	15
46	25	40	18	17	19	35	13	13
47	29	40	19	25	29	36	13	13
48	25	35	20	17	22	37	17	19
49	22	35	88	26	26	38	17	19
50	22	35	89	26	26	39	22	25
51	26	35	70	19	22	40	17	22
52	26	35	97	19	19	41	15	17
53	19	35	92	17	22	42	15	17
54	17	35	94	17	19	71	13	15
55	13	25	95	22	22	72	15	15
56	22	35				73	17	17
57	17	33				74	15	17
58	15	35				75	19	22
63	19	29				76	19	19
64	19	29				77	22	22
67	25	40				78	25	25
68	17	30				79	22	25
86	26	38				80	17	19
87	24	35				81	19	19
90	26	35				82	17	17
91	30	40				83	17	17
93	22	37				84	15	17
96	25	35				85	17	29
97	25	39				69	19	22
98	22	40				70	19	19
Total eyes		35			20			35
Mean rise in IOP		13.82			2.85			1.94
Mean ceiling pressure		36.0			18.25			18.45

Bloomfield and Lambert[4,2] felt that the latter was the more reliable of the two. One must agree with them, but it should be reëmphasized that the rise of 9 mm. Hg should not be overlooked. In this series there were only four cases whose tension failed to rise above

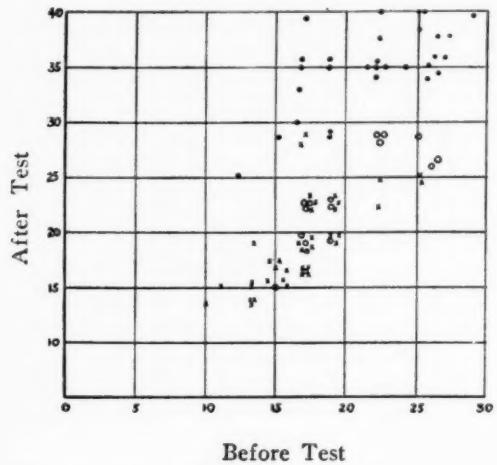

Fig. 1 (Stine). Effect of the pressor test on intraocular pressure. ● = Wide-angle glaucoma. ○ = Narrow-angle glaucoma. × = Normal.

30 mm. Hg following the test. Case 44 showed a rise of 10 mm.; Case 55, a rise of 12 mm.; while Case 63 and Case 64 each showed a rise of 10 mm. Hg.

The mean ceiling of the wide-angle group of glaucomas was 36 mm. Hg, while that of the narrow-angle group was only 18.25 mm. Hg. The ceiling of the normal group was 18.45 mm. Hg.

Figure 1 is a scattergraph showing the correlation between the three groups being tested in this study when the pressure before test is plotted against the pressure after the test. It will be noted that the plotted points of the cases of narrow-angle glaucoma are practically superimposed upon those of the normal cases. This is in sharp contradistinction to the grouping of the wide-angle group. This scattergraph graphically illustrates the facts brought out by the numerical tabulation of the results, that narrow-angle glaucoma cases respond to the pressor test in the same manner as does a normal individual.

Bloomfield and Kellerman[3] tested 77 normal eyes with this test and had only one positive. This series shows 35 normal eyes and likewise one positive which was apparently a false positive in the sense that no signs of glaucoma were present at that time If we combine the two series, we get a total of 112 known normal eyes in persons subjected to the test and only two false positives. The misclassifications amounted to 1.7 percent.

An analysis of the group with narrow-angle glaucoma showed that the mean rise in tension with the test was only 2.9 mm. Hg. The ceiling levels reached did not vary significantly from the normals. These cases were all proven to have glaucoma, however, by the presence of typical field changes, fundus pictures, and a positive provocative test with mydriasis. *These cases would have all been missed if reliance had been placed solely on the pressor test!*

A total of 82 eyes were subjected to mydriasis. Of these there were 33 with wide-angle glaucoma, 18 with narrow-angle glaucoma, and 31 normal eyes. Of the latter group, 5 had what would be classed as narrow angles.

TABLE 2

COMPARISON OF THE EFFECT OF PAREDRINE AND EUPHTHALMINE DILATION UPON THE INTRAOCULAR PRESSURE

Case No.	Initial Press.	Paredrine Dilation Pupil Size	Paredrine Dilation Final Press.	Euphthalmine Dilation Pupil Size	Euphthalmine Dilation Final Press.
6	17	6 mm.	22	7.0 mm.	35
13	17	7.5 mm.	19	8.0 mm.	29
17	19	7.0 mm.	22	7.0 mm.	28
88	22	7.0 mm.	25	8.0 mm.	35

From an examination of Table 3 it will be seen that the rise in pressure with mydriasis in the normal group was less than 1 mm. Hg, while the mean rise in the narrow-angle group was 14.33 mm. Hg. This should be contrasted with the mean rise of 3.69 mm. Hg in the wide-angle group of glaucomas with mydriasis.

In this study the mydriatics used were 2-percent or 5-percent homatropine, 5-percent euphthalmine, or 4-percent cocaine and 5-percent euphthalmine. Paredrine and neosynephrin were not included in this study because it was believed that their vasoconstrictive effects would often overbalance the mydriatic effect and thus introduce another variable.

It has been noted by other observers that paredrine is probably the safest of the mydriatics to use in the routine dilation of patients' eyes because it so infrequently causes a rise in intraocular pressure. Several of the eyes included in this study were dilated widely with paredrine with no appreciable effect upon the intraocular pressure; whereas, with euphthalmine and the same amount

TABLE 3

SHOWING THE COMPARISON OF THE EFFECT OF MYDRIASIS UPON EYES WITH WIDE-ANGLE GLAUCOMA, NARROW-ANGLE GLAUCOMA, AND NORMAL EYES

Wide-Angle Glaucoma				Narrow-Angle Glaucoma				Normal			
Case	Initial Press.	Final Press.	Pupil Size	Case	Initial Press.	Final Press.	Pupil Size	Case	Initial Press.	Final Press.	Pupil Size
4	26 H*	29	5.0 mm.	1	35 E′	60	8.0 mm.	25	15 H	15	7.5 mm.
7	22 H	25	7.5 mm.	5	19 E′	28	6.5 mm.	26	15 H	15	8.5 mm.
8	17 H	22	6.5 mm.	6	17 E′	35	7.0 mm.	27	13 H	13	7.0 mm.
9	29 E	32	6.0 mm.	13	17 E	29	8.0 mm.	28	13 H	13	8.0 mm.
10	40 E	40	7.0 mm.	14	17 E′	29	6.5 mm.	29	17 H	17	6.5 mm.
21	19 E′	40	8.0 mm.	15	19 E′	27	6.0 mm.	30	13 H	13	7.5 mm.
22	22 E′	35	6.5 mm.	16	19 E′	35	8.0 mm.	31	19 H	19	7.0 mm.
43	15 H	17	8.0 mm.	17	19 H	28	7.0 mm.	32	19 H	19	6.5 mm.
44	15 H	18	7.0 mm.	18	19 H	27	7.0 mm.	33	15 H	17	7.5 mm.
45	17 H	17	8.0 mm.	19	25 E′	35	6.5 mm.	34	15 H	17	8.0 mm.
46	25 E′	25	6.5 mm.	20	17 E′	25	5.5 mm.	37	19 H	19	8.0 mm.
47	27 E′	29	7.5 mm.	88	23 H	35	8.0 mm.	38	17 H	19	8.0 mm.
48	25 E′	25	7.0 mm.	89	22 E′	48	7.0 mm.	39	22 H	25	6.5 mm.
49	22 H	25	6.0 mm.	70	19 H	40	7.5 mm.	40	22 H	22	7.0 mm.
50	22 H	27	5.5 mm.	97	19 E′	35	8.0 mm.	41	15 H	15	7.0 mm.
53	17 H	20	8.0 mm.	92	17 E	40	6.5 mm.	42	15 H	15	7.5 mm.
54	17 H	19	6.0 mm.	94	19 E	35	7.0 mm.	71	17 H	17	6.0 mm.
55	15 H	15	5.0 mm.	95	22 E	40	7.5 mm.	72	15 H	15	6.5 mm.
56	19 H	22	7.0 mm.					75	19 H	22	7.0 mm.
57	17 H	19	6.5 mm.					76	19 H	19	6.5 mm.
58	15 H	17	7.5 mm.					77	22 H	22	8.0 mm.
63	17 H	22	8.0 mm.					78	25 H	25	8.5 mm.
64	22 H	22	5.0 mm.					79	19 H	22	6.5 mm.
67	22 E′	22	6.5 mm.					80	17 H	17	7.0 mm.
68	17 E′	17	7.0 mm.					81	22 H	22	7.5 mm.
86	25 E′	44	7.0 mm.					82	17 H	19	7.0 mm.
87	24 E′	38	7.5 mm.					83	17 H	17	8.0 mm.
90	25 H	25	6.0 mm.					84	17 H	17	6.5 mm.
91	29 H	30	5.5 mm.					85	17 H	19	7.5 mm.
93	22 H	25	6.5 mm.					69	19 H	19	7.0 mm.
96	25 E′	26	5.5 mm.					70	19 H	19	7.0 mm.
97	22 H	27	7.0 mm.								
98	22 E′	22	7.5 mm.								
Total Eyes		33				18				31	
Mean Press. Rise		3.69 mm. Hg				14.33 mm. Hg				0.51 mm. Hg	

* H denotes case where either 2% or 5% homatropine was used.
E denotes case where 5% euphthalmine was used.
E′ denotes case where 5% euphthalmine and 4% cocaine were used.

of dilation, there was a significant rise in pressure (table 2).

In this study the effect of mydriasis was studied by measuring the intraocular pressure before the installation of a mydriatic and then again at least every hour until it ceased rising. This procedure was followed in all the cases except the eyes with narrow-angle glaucoma, in which a miotic was instilled after it was found that a significant rise had occurred.

From Table 3 it will be seen that every case classed as narrow-angle glaucoma in this series gave a positive mydriatic test using as a criterion the commonly accepted figure of a rise of more than 6 mm. Hg. In the 33 eyes with wide-angle glaucoma only 4 showed a significant rise in tension under the influence of mydriatics. (See discussion of these cases later.)

Discussion

An examination of the above results suggest several important facts and possible clues to some of the factors in the production of the glaucomatous state. The pressor test of Bloomfield and Lambert has been confirmed as a valuable diagnostic procedure in the study of glaucoma. It now seems obvious that the test is highly reliable in detecting chronic simple glaucoma of the wide-angle type, but almost useless in detecting narrow-angle glaucoma, a point not brought out by their work. However, several side issues were raised which, upon investigation, may be of distinct importance.

It would appear from the results of this study that there are two distinct mechanisms operating in the production of wide-angle glaucoma as opposed to narrow-angle glaucoma. This is not a new idea and has been proposed by Barkan,[1] Kronfeld,[7,8] Sugar,[9] and others. There is not complete acceptance of the idea, however, since Troncoso[10] in his recent book, *Gonioscopy*, says, "At this time a warning should be sounded not to believe that the mechanical application of the iris base against the cornea is the cause, the *primum movens*, of the development of acute or subacute attacks of glaucoma. Narrowing of the angle is only a predisposing factor as will be explained later."

Kronfeld and others[7] studied the effect of mydriasis in patients with wide-angle glaucoma and came to the conclusion that the intraocular pressure is not grossly influenced by the administration of mydriatics. They did, however, elicit a small rise. This was confirmed in this study, where the mean rise in intraocular pressure in the normal group was only 0.5 mm. Hg, as contrasted with the mean rise of 3.69 mm. Hg in the group of wide-angle glaucoma.

It will be noted that in four eyes the intraocular pressure rose precipitously with mydriasis, but fell promptly with miosis. These cases were included in this group because it was felt from clinical course and examination that, although the angles were narrow with many anterior peripheral synechias, the primary etiology of the glaucoma was that of a disturbance of the trabeculum—canal of Schlemm—mechanism typical of the wide-angle glaucoma. It is believed that the rise in tension with mydriasis was due to the narrowness of the angle and the anterior peripheral synechias, making it possible for the iris base to block the angle.

The fact that in this study all of the eyes with wide-angle glaucoma responded with a significant rise in intraocular pressure to the pressor test, while the group of narrow-angle glaucoma responded with a rise not significantly different from that of the normals, seems to indicate that there is an entirely different mechanism operating in the production of the glaucomatous state in the two conditions.

The pressor test is a method of throwing a sudden strain upon the reserve capacity of the pressure-regulating mechanism of the eye, acting through the vascular bed, which is thought to be the effector organ of the pressure-regulating mechanism.

Inasmuch as there is no angle-crowding effect resulting from this test, it seems to in-

dicate definitely that the etiology of the glaucoma in the wide-angle type of glaucoma is due to some pathologic condition in the drainage mechanism in the trabeculum and canal of Schlemm, and not directly related to the base of the iris.

Friedenwald[5] has demonstrated that with a rise of 5 to 10 mm. Hg in intraocular pressure, the rate of outflow of the aqueous is more than doubled. It then stabilizes on the "Friedenwald plateau" where a rise in pressure up to about 30 mm. Hg does not increase the rate of outflow. He interpreted this initial rise as a reserve of safety in the pressure-regulating mechanism, and thought that normal eyes maintain their intraocular pressure by staying within the limits of the plateau. However, in a glaucomatous eye that has no such margin of safety, any sudden strain upon the outflow mechanism would lead to an increase in the intraocular pressure. This is the elevation that is being measured by the pressor test.

On the other hand, the fact that the group with narrow-angle glaucoma did not respond by a rise in pressure with the test would make it appear that the filtration mechanism of the trabeculum and canal of Schlemm is functioning normally or at least almost normally in this latter type of case. These cases did respond with a rapid and significant rise coincident with mydriasis, the rise occurring presumably as soon as the pupil had dilated sufficiently to crowd or even partially block the angle.

Such patients, when examined with the gonioscope while the intraocular pressure was elevated, showed that the angle which had been narrow before was now almost invariably completely closed with the iris in apposition to the cornea or sclera. When a miotic was instilled and the pupil began to contract, reëxamination with the gonioscope revealed the previously crowded angle to be opening and the pressure soon fell rapidly to its previous level.

This evidence seems too conclusive to be denied and appears to be a powerful supporting girder in the structure of the "iris-block" mechanism built up by Barkan,[1] Kronfeld,[7, 8] Sugar,[9] and others. It certainly must be admitted, however, that there are eyes that at the time of examination show a narrow angle and yet have normal tensions and no other evidence of glaucoma, but there is no assurance that these same eyes will not develop narrow-angle glaucoma sometime in the future.

Another fact brought to light by this investigation was a probable correlation be-

TABLE 4

SHOWING THE CORRELATION BETWEEN A POSITIVE PRESSOR TEST WHILE ON MIOTICS AND THE VISUAL-FIELD LOSS

Case No.	Tension Range on Miotics	Pressor Test on Miotics	Pressor Test no Miotic	Visual Fields
4	17–22	19 to 22	27 to 38	No loss for six months
7	15–24	17 to 24	22 to 34	No loss for two years
8	17–22	19 to 29	19 to 35	Steadily progressive loss
9	15–25	17 to 22	30 to 40	No appreciable loss for two years
10	19–25	19 to 25	40 to 56	Very slight loss over period of two years
21	15–27	17 to 35	17 to 37	Progressive loss
22	19–25	22 to 35	22 to 35	Progressive loss, central and peripheral
51	13–22	15 to 17	26 to 35	No loss over period of six months
67	17–28	19 to 35	25 to 40	Slow progressive loss past ten years
68	15–22	15 to 25	17 to 30	Slight, but definite loss, ten years
90	19–25	25 to 29	26 to 35	No significant loss for past year
91	19–28	25 to 35	30 to 40	Definite central and peripheral loss
93	17–22	22 to 25	22 to 40	No loss
98	15–25	19 to 35	22 to 37	Steady loss of peripheral field

tween a positive pressor test in eyes under the influence of miotics and the amount of visual field loss. Bloomfield and Lambert[4] in their paper noted that patients under the influence of pilocarpine did not show the expected rise in tension with the pressor test. This fact was confirmed early in the present study.

Subsequent investigation revealed that these patients who had a positive pressor test *despite normal tensions under miotics* were all gradually losing visual field and visual acuity and were, therefore, not really controlled. On the other hand, those patients that had a negative pressor test while under the influence of miotics had been without appreciable field loss for a considerable time. This series is illustrated in Table 4.

It will be seen that of 14 eyes, 7 had had a progressive field loss despite the fact that the tension had always been noted to be well within the so-called normal zone. The tension in the other seven eyes stayed essentially within the same range, but these eyes had sustained no significant visual-field loss over a rather lengthy period of observation. In every case where there had been progressive field loss, the pressor test was positive while the patient was on his usual miotic regime and, conversely, the pressor test was negative in those patients that did not show a progressive loss of the visual fields.

The small number of cases certainly does not entitle one to draw any very valid conclusions as to the prognostic value of the pressor test, but does provide a clue that is being investigated further in an attempt to establish the pressor test as a prognostic procedure which will enable the clinician to foretell what course a given case of glaucoma may take on conservative therapy.

Summary

The pressor test was found to be a safe, easily performed test for the detection of chronic simple glaucoma of the wide-angle type. It was found to be completely unreliable for the detection of glaucoma of the narrow-angle type. Therefore, it is recommended that the test be used only in conjunction with the gonioscopic examination when there is any question of its validity.

Mydriasis was found to be a very reliable provocative test for the detection of narrow-angle glaucoma, but, contrary to popular belief, had practically no effect on the intraocular pressure in the wide-angle type of glaucoma.

The response to the pressor test and mydriasis of the two types of glaucoma suggests that there are entirely different mechanisms operating in their etiology.

The pressor test may, by further investigation, be found to have very definite prognostic value in cases of wide angle glaucoma with respect to possible visual field loss.

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I wish to express my gratitude to Dr. L. T. Post, ophthalmologist-in-chief, and Dr. P. T. Shahan, chief of the glaucoma clinic, for making the facilities of the Washington University Eye Clinic available to me, and to Dr. R. G. Scobee for his very valuable advice in the preparation of this paper. The credit for the statistical analysis of the cases must go to Mrs. Hixson of the department of mathematics of Washington University.

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THE USE OF BACITRACIN IN OCULAR INFECTIONS*

Part II. Bacitracin Therapy of Experimental and Clinical Ocular Infections

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With the technical assistance of F. W. Kraft and H. J. Reingold.

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In the first part of this report,[1] we have shown that bacitracin may be safely employed on the external surface of the globe in concentrations up to 1,000 units per ml. saline. Bacitracin does not penetrate the normal cornea in appreciable amounts but does penetrate into the aqueous humor when the corneal epithelium is injured by physical, chemical, or infectious agents. Concentrations up to 100 units in 0.05 to 0.1 ml. saline, when injected into the vitreous humor, produced only minimal opacities. No fundus lesions were detectable with the opthhalmoscope. Because of this tolerance of ocular tissues to bacitracin, studies were undertaken to determine its value in experimental and clinical ocular infections.

A. Treatment of experimentally produced corneal infections

The organism used was a pathogenic strain of hemolytic Staphylococcus aureus, was coagulase positive, mannite fermenting, and sensitive to bacitracin. Broth cultures (18 to 24 hours) were used in concentrations varying from the undiluted broth to a concentration of 10^{-6}.

Using a specifically short bevelled 27-mm.-gauge needle attached to a tuberculin syringe, we injected into the corneal stroma in the pupillary area a sufficient amount of the culture to produce a 4-mm. bleb in both eyes. This procedure invariably produced within 24 hours a purulent conjunctivitis with corneal abscess followed by hypopyon and inflammation of the entire anterior segment. If untreated, the infection progressed until it involved most of the cornea, eventually healing with a dense, vascularized scar. In some instances the infection resulted in endophthalmitis or panophthalmitis leading to a granulomatous mass or phthisis bulbi.

For treatment of the corneal infections, bacitracin was used in a concentration of 1,000 units per ml. saline. The experimental procedures are grouped according to the period of time elapsing between inoculation and commencement of therapy, which varied from 30 minutes to 8 hours. In all cases the right eye received treatment, while the left served as a control.

Experimental procedures

In 15 rabbits the undiluted broth culture was employed. In 5 of these animals 2 drops of bacitracin solution (1,000 units per ml. of saline) were applied to the cornea within 30 minutes after inoculation and repeated every half hour for six doses. In no instances was there complete prophylaxis. However, in 4 out of 5 rabbits, the infection in the treated eye was much less severe than in the untreated.

In the next 5 rabbits of this group, treatment was initiated 1½ to 3 hours after inoculation. In these animals the infections in the treated and untreated eyes were equal.

The remaining 5 rabbits of this group received after an interval of one hour, a continuous corneal bath for half an hour in the right and a saline bath in the left eye.

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In 2 rabbits, the infection was completely prevented in the right eyes. In 2 other rabbits, infection was retarded so that at the end of 24 hours, small infiltrates were present. These lesions progressed to develop small ulcers which healed at the end of 8 days with small leukomas. The 5th animal showed at the end of 24 hours a slight haziness at the site of inoculation. However, at the end of 48 hours, this had progressed to a severe corneal infection.

In 6 other animals the staphylococcal broth culture was diluted 1:100 and this was used as the inoculum into the cornea. In 2 of these animals instillations in the right eyes of 4 drops of the bacitracin solution at hourly intervals for 4 times was begun one hour after inoculation. The treated eyes were completely protected from infection; whereas, the controls treated simultaneously with saline solution developed severe corneal infections. In 4 of the 6 animals, treatment was delayed for 2 to 2½ hours following inoculation. There was complete protection in one, retarded infection in 2, and no inhibition of the infection in the 4th animal.

When the culture was diluted 1:1,000 and injected into the corneas of 4 rabbits, the following results were noted. In 2 animals of this group, treatment was begun 2 hours after inoculation, resulting in complete protection in both cases. In 2 animals, treatment was delayed for 3 hours. One animal showed complete protection, while the 2nd developed only a small corneal infiltrate.

Another group of 11 rabbits was similarly injected with a 10^{-6} dilution of the staphylococcal broth culture. Treatment was instituted at 4 hours in 5 of these animals. There was complete protection in 4, and mild infection in one animal. The remaining 6 animals received treatment after 6 hours. In all cases a severe infection developed, equal to that occurring in the control eye.

Comment

The results of these experiments indicate that corneal infections produced by a virulent strain of hemolytic Staphylococcus aureus isolated from a patient with an acute conjunctivitis can be prevented by bacitracin, depending upon the number of organisms contained in the inoculum, the time interval elapsing before initiating treatment, the concentration of the bacitracin, and, finally, upon the duration of the contact between the organisms and the antibiotic.

Thus, when the undiluted broth culture was used as an inoculum, the application of bacitracin solution every 30 minutes for 6 doses inhibited but did not prevent the ultimate development of corneal infection; whereas, if a corneal bath of bacitracin was employed for one-half hour, the incidence of infection was reduced. Again, when a 1:100 dilution of broth culture was injected, the infection was completely prevented by the application of bacitracin at the end of one hour.

With a more dilute culture—for example, 1:1,000—the prophylactic activity was effective up to 3 hours; and finally, with dilutions of 10^{-8}, infections were prevented even 4 hours after the injection of the inoculum. However, with this last dilution, infection occurred uniformly if 6 hours were allowed to elapse before instituting treatment.

B. Treatment of Experimentally Produced Vitreous Infections

In the first part of this report[1] it was observed that up to 100 units of bacitracin 0.05 cc. of saline may be injected into the vitreous humor of the rabbit with the production of but minimal damage. The minor vitreous opacities resulting from such an injection were not sufficient to negate its use in severe intraocular infections, especially since it is known that up to the time of antibiotic therapy, purulent infection of the vitreous invariably resulted in vitreous abscess or panophthalmitis and any therapy, no matter how radical, that prevents the certain destruction of the eye would be justifiable as a therapeutic procedure. Therefore, investigations were undertaken to de-

termine the effectiveness of the intravitreal injection of bacitracin in experimentally produced intraocular infections.

Experimental procedures

Twenty-five rabbits received injections bilaterally into the vitreous of 0.05 cc. of a saline solution containing varying amounts of a virulent hemolytic Staphylococcus aureus broth culture. Bacitracin in amounts from 10 to 100 units dissolved in 0.05 cc. of saline was injected into the vitreous of the right eye at time intervals varying from simultaneous with inoculation up to 48 hours' delay.

Results

In these experiments, when the undiluted broth culture was inoculated into the vitreous humor, the resulting overwhelming infection was temporarily inhibited in the eye receiving a simultaneous injection of 10 units of bacitracin. However, after 48 hours both the control eyes and treated eyes showed infections of equal severity. With increasing dilutions of the culture, with the consequent decrease in the number of organisms inoculated, the effectiveness of bacitracin increased up to the point where a dilution of 10^{-8}, treated with a single injection of 100 units within 12 hours, completely prevented infection. Even after 48 hours, 100 units of bacitracin injected into the vitreous, which at this time showed severe intraocular inflammation, stopped the infection, leaving but the residual damage as evidenced by no further progress of the vitreous opacity; whereas, the course of infection in the control eye proceeded to vitreous abscess or panophthalmitis.

Comment

It appears from these results that the same factors that play a role in bacitracin therapy of experimental corneal infections are active in experimental intraocular infections. However, since the vitreous lies in a closed chamber, the contact between the antibiotic and the organisms is much longer than it is in treatment of the cornea. For this apparent reason, bacitracin is effective in producing prophylaxis even if applied 12 hours after the inoculation, while the inhibitory effect on the infection extends as long as 48 hours.

C. Bacitracin therapy in ocular infections of man

Forty-three cases of external ocular infection were treated with bacitracin. These cases were divided as follows: 16 cases of acute conjunctivitis, 3 cases of acute keratoconjunctivitis, 5 of acute exacerbations of chronic conjunctivitis, 18 of chronic conjunctivitis, and 1 corneal infection (Table 1).

Comment

Of the 16 cases of acute conjunctivitis treated with bacitracin, 8 recovered rapidly, 3 improved slowly with recovery occurring between 8 to 15 days; in 5, the efficacy of bacitracin was doubtful since recovery was quite slow. In view of the fact that acute conjunctivitis in many instances is a self-limited disease, it is impossible to evaluate the results of bacitracin therapy from the small number of cases of acute conjunctivitis reported here. However, it appears that in those acute cases where sensitivity tests show the organisms to be susceptible to small amounts of bacitracin, recovery is rapid. Whereas, if the susceptibility is slight the response is much less satisfactory.

There were 3 patients in whom a diagnosis of acute keratoconjunctivitis was made. These patients before receiving bacitracin had been treated unsuccessfully with sulfonamides and penicillin. In two cases recovery occurred within 5 days after instituting bacitracin therapy. In the third patient, bacitracin was ineffective, but the infection yielded very rapidly to aureomycin.

In the 5 cases in which an acute flare-up occurred in the course of a chronic conjunctivitis, unmixed hemolytic Staphylococ-

TABLE 1

CLINICAL CASES TREATED WITH BACITRACIN

No. of Cases	Bacteriology	Coagulase Test	Sensitivity to Bacitracin	Results
	ACUTE CONJUNCTIVITIS			
16	*Unmixed Cultures*			
	7 with hem. Staph. aureus	2 positive 4 negative 1 not done	all sensitive to bacitracin	5 rapid recovery 2 questionable effect
	Mixed Cultures			
	6 hem. Staph. aureus	3 positive	3 sensitive to 0.5 units bacitracin	1 rapid recovery
	1 with subtilis	2 negative	3 hem. Staph. aureus	3 improved
	1 with diplococcus	1 not done	3 hem. Staph. aureus sensitive to 10.0 units of bacitracin	2 questionable effect
	1 with gram-pos. rod			
	1 with diphtheroid and proteus			
	1 with diphtheroid			
	1 with streptococcus			
	2 Pneumococcus		2 sensitive to bacitracin	2 rapid recovery
	1 nonhem. Staph. aureus with Strept. hem.	Negative	1 not done	1 questionable effect
	ACUTE KERATOCONJUNCTIVITIS			
3	No growth	—	—	2 recovery in 5 days 1 failure
	ACUTE EXACERBATION OF CHRONIC CONJUNCTIVITIS			
5	*Unmixed Cultures* 5 hem. Staph. aureus	4 positive 1 negative	4 sensitive 1 not done	5 improved
	CHRONIC CONJUNCTIVITIS			
18	*Unmixed Cultures* 13 hem. Staph. aureus	5 positive 7 negative	11 sensitive to bacitracin 2 not done	6 improved 12 questionable effect and/or complete failure
	Mixed Cultures			
	3 hem. Staph. aureus with diphtheroid	2 negative 1 not done	not done	
	1 hem. Staph. albus with diphtheroid	1 negative	not done	
	1 no growth	—	—	
	CORNEAL ULCER			
1	Gram-negative rod (atypical Ps. aeruginosa)		sensitive to 12 units of bacitracin	rapid recovery

cus aureus were cultured. In 4, the coagulase test was positive and one was negative. In 4, the organisms were found to be sensitive to bacitracin and in one the sensitivity tests were not done. All 5 showed rapid improvement of the acute symptoms with bacitracin therapy. In this group, as in the cases of an acute conjunctivitis, the number of cases is too few upon which to base any final judgment. However, all indications

pointed to the fact that the antibiotic helped in clearing the acute phases of the disease.

Bacitracin therapy in the 18 cases of chronic conjunctivitis treated with bacitracin leaves much to be desired. It appeared ineffective or only of slight value in 12 cases but a rapid improvement followed bacitracin therapy in 6 cases. Therefore, in chronic conjunctivitis, bacitracin was found to be no more effective than sulfonamide, penicillin, or streptomycin used in similar cases.

In the one case of corneal ulcer in which an atypical Pseudomonas aeruginosa was found, rapid recovery followed the institution of bacitracin therapy. Earlier treatment with sulfonamides and penicillin was ineffective.

Discussion

Experimental infections of the cornea and vitreous humor produced by a sensitive strain of hemolytic Staphylococcus aureus can be prevented by bacitracin. Prophylaxis is effective up to 4 hours for the cornea and up to 12 hours for the vitreous infection. In the vitreous, bacitracin will stop the infection even if the antibiotic is injected intravitreally up to 48 hours following the inoculation. This difference in the length of time that prophylaxis is effective in the cornea and in the vitreous humor is explained by the fact that in the latter media the contact between the antibiotic and the infectious agent is constant for a longer period of time.

The safety and effectiveness of bacitracin therapy in experimentally produced infections in the rabbit were sufficiently encouraging to us to use this new antibiotic in clinical ocular infections. Our clinical material consisted entirely of external infections of the eyeball and the adnexa. With the exception of one corneal infection, all cases were of conjunctivitis or blepharoconjunctivitis.

The rapid response to bacitracin in the corneal infection due to an atypical Ps. aeruginosa and in 2 of 3 cases of acute keratoconjunctivitis was significant because the patients had been treated previously unsuccessfully with sulfonamides and penicillin. The effect of bacitracin in the cases of conjunctivitis and blepharoconjunctivitis seemed to depend upon the duration of the infection.

Results in the acute infections or acute exacerbations of the chronic infections, particularly in those in which the organisms were susceptible to bacitracin, were good. In the chronic infections the results were disappointing, leading to the conclusion that bacitracin is no different from the other numerous therapeutic agents, including antibiotics, all of which have been found wanting in chronic conjunctivitis. It is possible that the combination of two or more agents to which the organisms are susceptible may prove to be more satisfactory and should be tried.

Although a suitable case for intraocular injection of bacitracin did not present itself during the time of these investigations, it seems reasonable to assume that in selected clinical cases this procedure should prove valuable. Thus in impending purulent ophthalmia, where the old, conservative measures have invariably failed, a direct intravitreal injection of bacitracin, combined with either penicillin or streptomycin or both, is indicated.

Summary

Bacitracin was found to be well tolerated by the intact eye when applied topically either as a fine powder or in saline solutions containing 1,000 to 5,000 units per ml. On the denuded corneas, solutions containing 1,000 units bacitracin per ml. did not appreciably delay the regeneration of the corneal epithelium. However, a solution containing 5,000 units per ml. caused a definite retardation of the epithelial regeneration with subsequent vascularization and scarring of the cornea.

Bacitracin did not penetrate through the normal cornea but did penetrate injured and inflamed corneas. The penetration following

abrasion of the cornea, vaccinia infection, addition of a surface-active chemical agent (aerosol O. T.), or during ion-transfer, was roughly proportional to the surface area affected. From this we conclude that the penetration depends not so much upon the agent as upon the amount of epithelial damage produced by the agent.

Bacitracin injected into the vitreous in concentrations up to 100 units in 0.1 cc. saline solution resulted in the immediate appearance of vitreous opacities. These frequently disappeared within a period of several weeks. Ophthalmoscopic examination of the oculi fundi failed to reveal any alterations.

Experimentally produced corneal and vitreous infections by the inoculation of a bacitracin-sensitive hemolytic Staphylococcus aureus can be prevented when treated with bacitracin within a definite time interval. Bacitracin will check vitreous-humor infections if injected intravitreally even 48 hours after the inoculation. A single case of corneal infection from which an atypical Ps. aeruginosa was isolated, responded promptly to bacitracin applied locally. Forty-two clinical cases of conjunctivitis and blepharoconjunctivitis were treated with bacitracin. The results on a whole were good in acute infections, in 18 chronic cases improvement followed bacitracin therapy in 6 patients while in 12, the response was less satisfactory or failed completely.

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Historical Miniature

Nero is said to have viewed the games through a piece of green beryl. The German name for spectacles, Brillen, arose from the word beryl. Nero may have used the beryl merely as filter for strong sunlight, but it has also been suggested that it may have been a concave monocle for a myopic eye. There is no evidence to substantiate this speculation.

OPERATIVE TREATMENT OF VERTICAL TROPIAS*

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Surgical relief for the discomfort of vertical tropias has progressed remarkably since Duane and his pupil, White,[1] performed one of the first tenotomies on the inferior oblique muscle. The operation was so successful that the squint was improved, the head tilt was relieved, and the torticollis disappeared. Duane and his protégés continued study and operations on the obliques in spite of the prejudice incited by von Graefe's warning of "hands off the obliques."

The new appreciation of the function and action of the vertically acting muscles resulted in the development of better surgical procedures based on more accurate diagnoses. Just as Duane and White and later Brown[2] have contributed so greatly, Wheeler,[3] Dunnington,[4] Berens,[5] and others have developed new operations and added refinements and innovations to various techniques. Although perfection has not been attained in the field of vertical surgery, the results are improving due to a better understanding of the problems involved.

ROUTINE OF EXAMINATION

Accurate diagosis of the muscle or muscles involved in vertical tropias has such an important bearing on the outcome of surgery that a routine for examination is suggested:

1. History, general and ophthalmic
2. Visual acuity and accommodation determinations, without and with glasses
3. Muscle balance and fusion tests
4. Refraction and correction with glasses
5. Orthoptic treatment
6. Operation and follow up

It is generally agreed that a carefully recorded history of the patient and his antecedents may give valuable information as to the development of strabismus and have considerable influence on the procedure to be followed. The possibility of general disease and nervous manifestations, as well as birth accidents and injuries, should be considered.

In the examination of the patient, a determination of the uncorrected visual acuity should be followed by a record of the vision with glasses. The amount of squint relieved by lenses, if due to accommodation, may alter the extent of the operation.

Estimation of the amount of phoria or tropia in the primary position and in the six cardinal directions of gaze should be performed by means of an opaque disc and square prisms to neutralize the shift of the eyes. A careful observation of the associated parallel movements in the various fields of gaze may give the evidence needed for the diagnosis. Eye dominance is determined because most surgeons prefer to operate on the nondominant eye. The near point of convergence, if present, should be measured. Tests for binocular single vision should include some variation of stereoscopic tests to determine the degree of fusion.

Proper lens corrections, incluring small vertical prisms when needed, should be worn for a reasonable time. If glasses and orthoptic exercises fail to improve the condition, the patient should have the benefit of intelligent surgery. Orthoptic exercises should follow surgery if the degree of fusion warrants it.

Before operating, the surgeon should have a clear picture of the condition as it exists and be sure that surgery will help the condi-

* Presented at the clinical congress of the American College of Surgeons in New York City, September 9, 1947.

Note: The material reviewed for this paper was taken from the six ophthalmic services of the New York Eye and Ear Infirmary with the assistance of Dr. W. F. Johnson, Dr. Carey Legett, Jr., Dr. George O. Emerson, and Dr. Donald S. McCann.

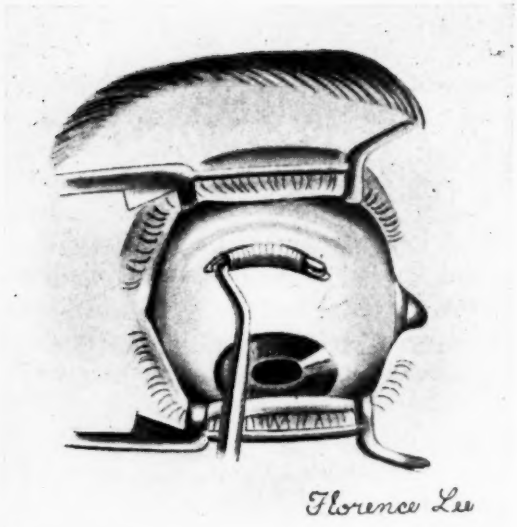

Fig. 1 (Payne). Exposure of the superior rectus muscle for resection.

Fig. 2 (Payne). Severance of the superior rectus muscle with fixation clamp applied.

tion and not make it worse. If the patient has no symptoms and is content with his appearance he should be left alone.

Operative objective

The operative objective in the correction of vertical tropias is to give horizontal alignment to the visual axes of the two eyes. This may be done in one of three ways or by a combination of the three.

1. Strengthening the weak or paralyzed muscle by a shortening operation.

2. Weakening the contralateral synergist by a tenotomy or recession.

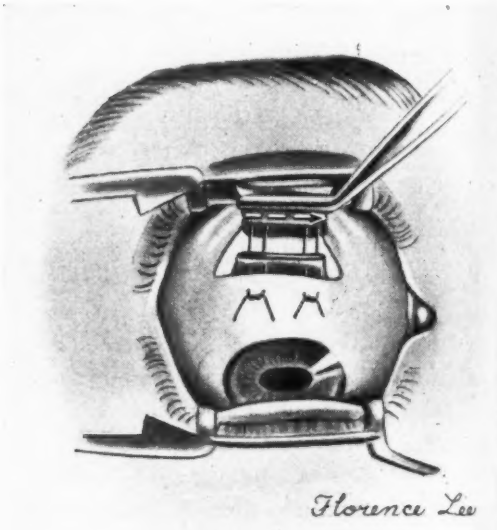

Fig. 3 (Payne). Application of two double-armed sutures posterior to the line of severance.

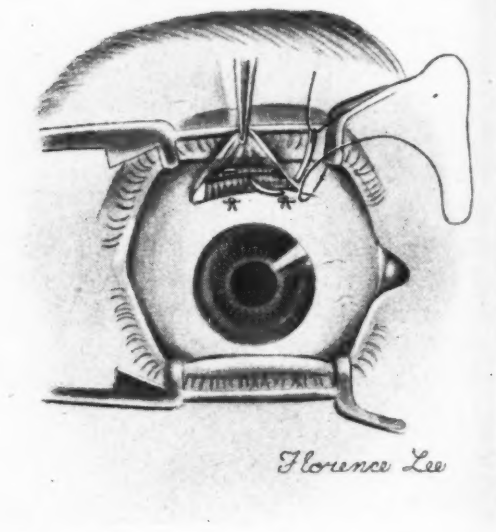

Fig. 4 (Payne). Sutures tied after muscle shortening and beginning of conjunctival closure with continuous stitch.

3. Weakening the antagonist of the same side by recession or tenotomy.

In small degrees of hypertropia, a resection of the semiparetic muscle is preferred to weakening the synergist of the opposite side. A marked upshoot of the synergistic eye caused by an overactive muscle usually needs correction by operation.

Review of cases

A review of 50 of the cases operated on for the correction of vertical tropia on the six ophthalmic services at the New York Eye and Ear Infirmary during the past two years showed that the inferior oblique muscle was selected for surgery in 90 percent of the operations. With the exception of six patients, on whom the inferior oblique alone was operated, either the lateral muscles or the opposite superior rectus were included in the surgery. From these observations it

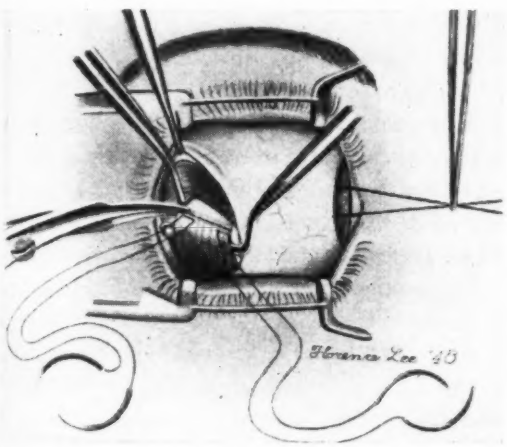

Fig. 5 (Payne). Line of incision and placing of sutures for recession of the right inferior oblique muscle.

would seem that practically all cases of vertical tropia are associated with lateral deviations but that, once the vertical deviation is corrected, either by prisms or operation, the lateral position is diminished and, in small amounts, disappears entirely.

The prevailing operation was recession of the inferior oblique in conjunction with

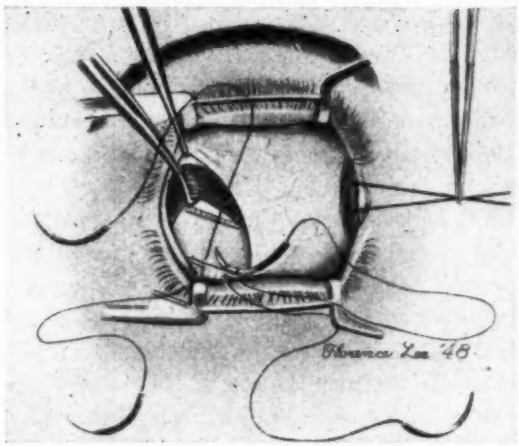

Fig. 6 (Payne). Insertion of sutures into episclera.

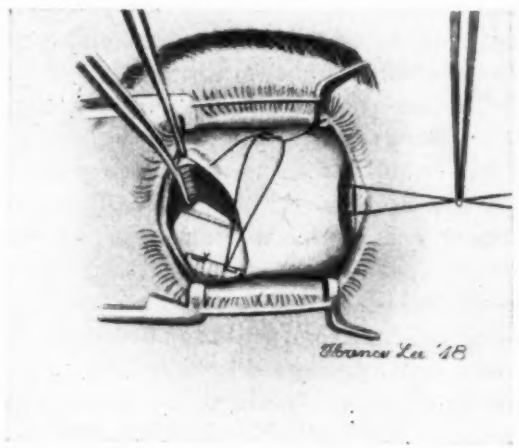

Fig. 7 (Payne). Sutures fixed and tied in episclera.

operations on the horizontally acting muscles. The results were good in 80 percent of the cases but when the diagnosis was uncertain and the operator failed to follow the teachings of Duane, White, Dunnington, and others, he was embarrassed and the patient suffered. There were no operations on the superior oblique in this group.

The following cases illustrated good and bad results in operations for vertical deviations of the eye.

Case reports

Case 1 (C55627). A child, aged 11 years, having 20/40 vision in the right eye with a +0.5D. sph. and 20/30 in the left eye with

the same correction, presented a head tilt to the left shoulder. The near point of convergence was 150 mm. and in the primary position measured an esotropia of 8 prism diopters (p.d.), with a right hypertropia of 25 p.d. both for distance and for near.

On looking up and to the right, there was an exotropia of 3 p.d. On looking to the right, there was an esotropia of 6 p.d. with a right hypertropia of 14 p.d. On looking to the right and down, there was an esotropia of 16 p.d. with a right hypertropia of 14 p.d.

On looking up and to the left, there was a right hypertropia of 40 p.d.; looking to the left, there was a right hypertropia of 50 p.d.; and looking to the left and down, there was an esotropia of 4 p.d. with a right hypertropia of 30 p.d.

The surgery in this case consisted of a 9-mm. recession of the right inferior oblique. This resulted in a change in the near point of convergence from 150 to 55 mm. The right hypertropia for distance and near was reduced from 25 to 5 p.d.

On looking up and to the right, there was a left hypertropia of 3 p.d.; on looking to the right, orthophoria; on looking to the right and down, a right hypertropia of 7 p.d., with an esotropia of 3; on looking to the left and up, there was a right hypertropia of 5 p.d.; on looking to the left, a right hypertropia of 7 p.d.; and on looking to the left and down, a right hypertropia of 12 p.d., with an esotropia of 3 p.d.

In this case there was a change of approximately 2.1 diopters for each millimeter of recession when measured in the primary position and approximately 4 diopters per millimeter of recession when measured in the field of action of the muscle.

Case 2 (C193565). A child, aged 5 years, had 20/30 vision in the right eye, and 20/70 vision in the left eye. The measurements in the primary position at 6 meters were an esotropia of 20 p.d. with a right hypertropia of 2 p.d.; while at 25 cm., there was an esotropia of 25 p.d. and the right hypertropia remained constant at 2. On looking up and to the right, there was a left hypertropia of 10 p.d., plus, and an esotropia of 30. On looking up and to the left, there was a right hypertropia of 12 p.d. (double hypertropia) and an esotropia of 35 p.d.

The following recessions were done: right inferior oblique, 5 mm.; left inferior oblique, 4 mm.; and the left medial rectus, 3 mm.

This resulted in an esotropia of 9 p.d. for distance and 12 p.d. for near with a question of a slight right hypertropia with correction.

On looking up and to the right, there was an esotropia of 8 p.d.; and on looking up and to the left, there was an esotropia of 8 and a right hypertropia of 2 p.d. This resulted in a change of 2½ diopters for each millimeter of recession (the change being measured in the field of action of the muscle).

Case 3 (C21679). A child, 11½ years of age, having 20/30 vision in the right eye with a +3D. sph., and 20/200 n the left eye with a +4D. sph., had a near point of convergence of 40 mm. without correction, and 70, with correction.

The measurements in the primary position at 6 meters were an esotropia of 12 p.d., with correction and 20 without correction; while for near, there was an esotropia of 15 p.d., with correction and 35 without correction.

On looking to the right and up, there was an esotropia of 20 p.d., plus, and a left hypertropia of 2 p.d.

On looking to the right and to the right and down, there was an esotropia of 20 p.d. On looking up and to the left, there was an esotropia of 5 p.d. and a right hypertropia of 2 p.d. (double hypertropia). On looking to the left, there was an esotropia of 18 p.d., and on looking to the left and down, there was an esotropia of 16 p.d.

A diagnosis of convergence excess and bilateral superior rectus paralysis was made.

The following surgery was done: resection of the left lateral rectus, 8 mm.; recession of the left inferior oblique, 5 mm. While this case showed a double hypertropia of 2 p.d. before surgery, it still shows about 2½

diopters for each of the 5 mm. that the left inferior oblique was recessed.

The results were as follows: On looking up and to the right, there was an esotropia of 14 p.d., plus, with a right hypertropia of 10 p.d., on looking to the right, there was an esotropia of 12 p.d., with a right hypertropia of 10; on looking to the right and down, there was an estropia of 10 p.d., plus, with a slight right hypertropia; on looking up and to the left, there was an esotropia of 12 p.d. with a right hypertropia of 14; on looking to the left, there was a question of an exotropia with a right hypertropia of 10 p.d., and on looking to the left and down, there was an esotropia of 12 p.d., with a variable right hypertropia.

Case 4 (C53306). A child, aged 9 years, had 20/30 vision in both eyes and showed, on looking up and to the right, a left hypertropia of 20 p.d. and an esotropia of 40 p.d. On looking to the right, there was a left hypertropia of 8 p.d. and an esotropia of 55. On looking up and to the left, there was a right hypertropia (double hypertropia) of 12 to 15 p.d. and an esotropia of 35 to 40 p.d.

On looking to the left, there was a right hypertropia of 7 to 8 p.d. and an esotropia of 35 to 40 p.d. On looking to the left and down, there was a right hypertropia of 5 p.d. and an esotropia of 50.

The following recessions were done: left inferior oblique, 5 mm.; left medial rectus, 3 mm.; right inferior oblique, 3 mm.; and the right medial rectus 2½ mm. This resulted in an esophoria of 12 p.d. in the primary position.

Apparently, the surgery to the obliques resulted in a change to the hypertropias of about 1½ to 2½ diopters for each millimeter of recession if measured in the lateral positions, and about 4 diopters for each millimeter of recession when measured in the superior cardinal positions.

Case 5 (C72044). This young adult, aged 15 years, had a squint of 9 years' duration. His vision was 20/20 in both eyes and he measured, in the primary position, an esotropia varying between 60 and 70 p.d., with a left hypertropia of 10 p.d.

Looking up and to the right, there was a left hypertropia of 14 p.d., and in the other cardinal positions of gaze there was a left hypertropia of 8 to 10 p.d.

After a resection of 10 mm. on the right lateral rectus, 9 mm. on the left lateral rectus, and a recession of 3 to 4 mm. on the left inferior oblique, there resulted in the primary position an esotropia of 12 p.d. and no hypertropia. In this case the surgery to the left inferior oblique resulted in a change of about 3 diopters for each millimeter of recession.

Case 6 (B91919). This last case is included through the courtesty of Dr. W. F. Johnson and preoperatively presented a head tilt to the left, and a near point of convergence of 130 mm. In the primary position, without correction, there was a right hypertropia of 35 p.d., with an exotropia of 15 p.d. for distance; while for near, there was a right hypertropia of 18 p.d. and an exotropia of 18. The field of binocular single vision extended from the right to eyes front. On looking up and to the left, there was a right hypertropia of 30 p.d.

In this case, a 9-mm. recession of the right inferior oblique was performed. Following surgery, the field of binocular single vision was enlarged to the left; the head was held straight, the near point of convergence was reduced from 130 to 60 mm.

In the primary position, without correction, for distance and near, there was an exophoria of 5 to 8 p.d., with a slight right hypertropia. On looking up and to the left, there was a right hypertropia of 5 p.d. So in this case, for each millimeter the right inferior oblique was recessed, there was a change of 2 to 2½ diopters.

Discussion

From the above cases it will be seen that, with each millimeter of recession of the inferior oblique, approximately 2½ prism diopters of correction was attained. These

operations were performed by both residents and surgeons and included the lateral muscles. The evidence is not uniform and it is doubtful if the figure is of any practical value. It is interesting to note, however, that the same findings hold true in the unsuccessful case mentioned above.

Aside from Johnson's[6] simplified approach to the inferior oblique, which is similar to the linear incision parallel to the lower border of the lateral rectus used by Berens,[7] no new procedure has been developed at the New York Eye and Ear Infirmary. There is a tendency of some surgeons to use 4-0 plain catgut sutures rather than nylon or silk for the scleral reattachment of the muscle. Absorbable sutures hold the muscle in place for a sufficient length of time and there is little reaction to them.

A word of warning with reference to the important structures in the neighborhood of the scleral attachment of the oblique muscles is directed to the neophyte. There is danger of injury to the long ciliary nerve and parts of the muscular attachments are very close to the macular region. The vortex vein is exposed frequently and subject to trauma and the surgeon should remember that anomalous attachments between the oblique muscles and the lateral rectus may be found.

It is well to repeat Krewson's[8] conclusions that, if a choice is permitted, weakening of a depressor muscle is undesirable; strengthening of a depressor or weakening of an elevator muscle is preferable, for there is greater need for binocular vision in the lower than in the upper fields.

Conclusions

1. Carefully planned operations for the relief of vertical tropias are successful if the diagnosis is correct.

2. A clear understanding of the muscle or muscles involved is essential.

3. The type and extent of the operation will be determined by the points brought out in the complete examination.

4. Injury to neighboring structures should be avoided.

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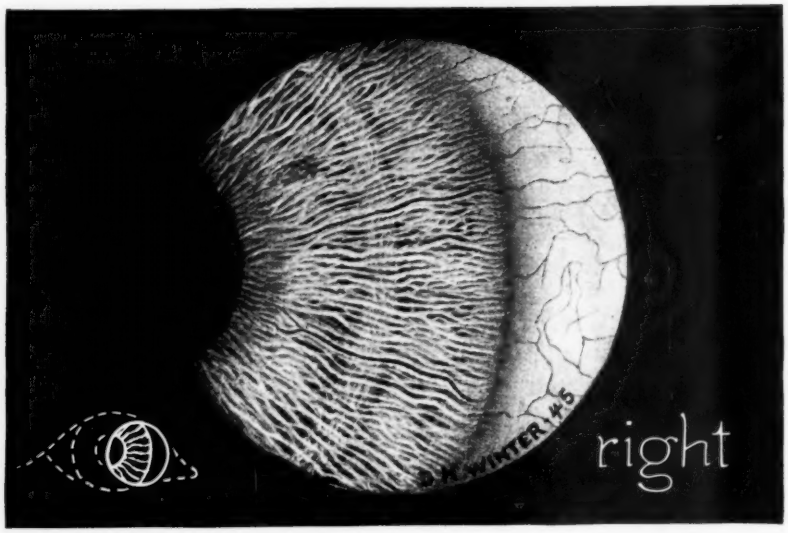

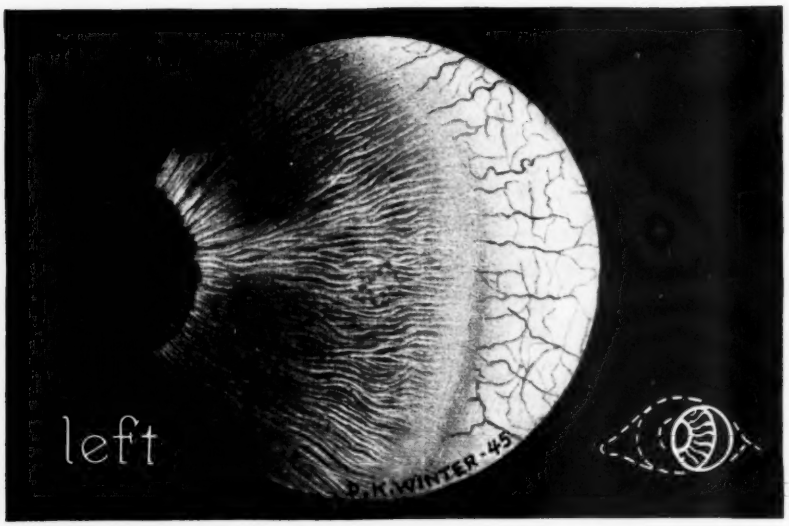

FIG. 1 (RICHARDSON). CASE 1. DRAWINGS OF QUADRANTS OF IRIS. RIGHT, THE UNAFFECTED EYE. LEFT, THE AFFECTED EYE.

DIFFUSE MALIGNANT MELANOMA OF THE IRIS*

Report of two cases

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A survey of the literature offers convincing evidence of the rarity of primary malignant melanoma of the iris. The number of recorded cases is estimated by Duke-Elder[1] at 150 and by Doherty[2] at about 175. It is generally stated that of malignant melanomas in the uveal tract, 85 percent occur in the choroid, 9 percent in the ciliary body, and 6 percent in the iris. McKee[3] observed that this ratio is somewhat proportional to the amount of uveal pigment present.

Usually circumscribed, this lesion of the iris may be diffuse, and it may also be pigmented or unpigmented. Although the descriptive literature is often not explicit enough to make differentiation between the circumscribed and the diffuse types clear, the diffuse tumor appears to be extremely rare. Recently, Wilder[4a] stated that there are 7 instances of diffuse malignant melanoma of the iris in the files of the Army Institute of Pathology. In presenting 1 case in 1923, Li[5] was able to collect only 5 cases in the literature. Doherty[2] in 1939 included in his complete bibliography (1919-1937) but 5 additional cases, designated as ring sarcoma of the iris. Among the 263 cases of uveal sarcoma in Martin-Jones's recent comprehensive study,[6] there was 1 case of ring sarcoma. Two cases that came under my care within a period of 13 months are reported here.

Nomenclature

Malignant melanoma of the iris is variously referred to in the literature as sarcoma, melanosarcoma, and ring sarcoma. Malignant melanoma is, however, to be preferred. In the view of some authors, melanoma carries with it the connotation of malignancy, and nevus is applied to the nonmalignant pigmented tumor. Nevertheless, in opthalmology there is need for the more exact definition of benign or malignant melanoma, for in the eye are present mesodermal melanoblasts, from which arise both benign and malignant tumors.[7] When not circumscribed, the malignant melanoma of the iris is appropriately described as diffuse or infiltrating. First differentiated by Fuchs,[8] this type came to be described as flat sarcoma, and, in 1898, Ewetzky[9] suggested the term ring sarcoma, which seems to have the preference in the literature.

Age and sex incidence

Most authorities are agreed that malignant melanoma of the uveal tract is more prone to develop in persons in the sixth decade. It has been noted, however, that in the iris this tumor occurs on the average some 10 years earlier than those in the ciliary body and choroid, at approximately the age of 40 years instead of 50 years. This conclusion is borne out in my cases. Wilder[4b] mentioned a series of 137 malignant melanomas of the iris in which 51, or 37 percent, were from patients under 40 years of age, confirming Duke-Elder's statement that the average age of occurrence for tumors of the iris is lower than for the remainder of the uveal tract.[1]

Martin-Jones[6] concluded that this neoplasm of the iris occurs with greater frequency in women. Three of the 4 cases in his recent series, including the 1 case of ring sarcoma, were in women, and he cited Pflüger's 23 cases with 15 in women and Treacher Collins' 18 cases with 10 in women. Five cases of ring sarcoma cited by Li[5] were in women, although his 1 case was not, nor was Bruner's case.[10] In 1 of my 2 cases the patient was a woman.

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Etiology

The method of origin of the malignant melanoma remains a matter of controversy. Opinions vary as to whether it arises from endothelium, epithelium, or chromatophores. In contradistinction to the epiblastic theory of Verhoeff,[11] there is the more recent neuroectodermal theory advanced by Masson[12] and supported by the later researches of Theobald.[13]

The role of injury in the etiology of this tumor is problematical, as is that of prolonged inflammation. It is, however, well known that benign melanomas of the iris undergo malignant changes and should rightly be regarded with suspicion. Martin-Jones[6] concluded that abnormal ocular pigmentation is an etiologic factor in some cases of sarcoma of the uveal tract, the evidence being more in favor of abnormal masses of pigmentation in the iris becoming malignant than those of the choroid.

Reese[7] concluded that a melanoma of the uvea may be malignant at one site and benign at one or several other sites, thus representing multiple origins of the tumor. Noting that the iris is a common site for the benign feature, he regarded this lesion of the iris as a diagnostic aid when observed clinically. He commented that the ring nature of a melanoma may be accounted for in part by multiple diffuse origins as well as implantation growths which logically occur around the filtration angle, where disseminated tumor cells in the anterior chamber would tend to gather. Too, he was of the opinion that an important difference between a localized malignant melanoma of the uvea with benign melanomas elsewhere and a diffuse and ring type of melanoma lies in a malignant effect of the cancerigenic agent at one site and a benign effect elsewhere in the one case, and a diffuse, multiple, malignant effect in the other cases.

Pathology

The cell types on which the classification of Callender[14] is based include spindle cell with subtypes A and B, fascicular, epithelioid, mixed, and necrotic. From their study of 500 cases of malignant melanoma of the choroid and ciliary body, Callender, Wilder, and Ash[15] concluded that the pure spindle cell types, particularly subtype A, are of a relatively low degree of malignancy, that an increased degree of malignancy is associated with the presence of epithelioid cells, and that a low degree of malignancy is usually associated with a heavy fiber content. Wilder[4b] explained the observation that melanomas of the iris behave less malignantly than do those of the choroid on the ground that they are readily visible and consequently recognized earlier.

Whether the tumor starts at the root of the iris or in the region of the ligamentum pectinatum, these structures as a rule become rapidly involved. An increase in size denotes the extension in a definite pigmented nevus. If, however, the growth originates in the deeper layers of the iris near its root, it may spread beneath the stroma, causing discolorations varying from light yellow to dark brown. This type of growth tends to metastasize into the fibers of the ligamentum pectinatum and the canal of Schlemm, with resulting increased tension. Metastasis around the angle of the anterior chamber produces the diffuse or ring type of tumor.[2]

In its evolution, the diffuse tumor is distinguished from the circumscribed variety by its slow growth with long preservation of vision and lack of objective signs, its diffuse infiltration of the uveal tract, and the extent of its metastatic spread. Duke-Elder[1] estimated the length of the history from 7 months to 10 years and regarded it as the most conspicuous feature. In this connection it is of interest that in Bruner's case,[10] the patient "had always noticed a little colored spot on the inner half of the iris." In Li's case,[5] there was a history of trauma 2 years previously. Of the cases collected by Li,[5] in Solomon's case,[16] the patient had observed for 20 years a speck on the iris gradually increasing in size; in Hanke's case,[17] the

growth evidently antedated the failing vision of 9 months' duration by a considerable period; in Alt's case,[18] the patient had observed a spot on the iris for several years; in Levan's case,[19] a pigmented nevus was observed for several years with increase in size and several pigmented spots not noted previously appearing 1 year before removal of the eye; and in Pindikowski's case,[20] the patient had noticed the tumor for some time. In my cases, 1 patient thought that the affected eye had been discolored for several months, and the other patient had been aware of a dark brown spot on the iris of the involved left eye for many years with gradual change in color of the iris to dark brown over an indefinite period of years, the iris of the right eye being blue.

Diagnosis

It may be impossible at first to distinguish between benign and malignant melanomas unless microscopic examination is made possible by iridectomy. The benign lesion characteristically attains a certain size and remains so; it does not project much above the plane of the iris. Too, vascularization is uncommon in the innocent tumor. Beginning malignancy manifests itself clinically by an increase in size, varying discolorations in the same growth, an increased blood supply, an elliptical pupil, and development of abnormal tension.[2]

Martin-Jones[6] observed that malignant melanoma of the iris may give rise in some cases to no subjective symptoms, being discovered only on routine examination; in other cases, the patient may seek advice because of a small brown or blackish spot on the iris, present as long as he could remember or since birth, and believed to be increasing in size. Extension of the growth over the pupillary margin may interfere with vision, as may intraocular pressure if the tumor grows sufficiently. Analysis of the pathologic reports in my cases would seem to indicate that the glaucoma was secondary to the infiltration of pigment and tumor cells into the filtration angle.

The position on the iris is a consideration of some importance in diagnosis. In the order of frequency, the lower half, the upper half, the inner segments, and the outer segments are affected.

In differential diagnosis, inflammatory granulomas, especially tubercle and syphilis, are to be considered, as are secondary tumors and cysts. The flat diffuse lesion is sometimes mistaken for iridocyclitis. When the secondary glaucoma manifests itself, it is difficult to be sure that this condition is not primary.

Prognosis

Despite the relatively slower progress of malignant melanoma in the iris, the prognosis is uncertain at best. There appears to be no time limit of safety. Even enucleation at an early stage does not preclude metastases, and, after extraocular extension, fatalities rapidly increase. Infiltrating growths are more dangerous than the discrete variety.

Considering this tumor in the uveal tract as a whole, Martin-Jones[6] concluded that the case is quickly and invariably fatal if melanogen is present in the urine. It was not present in either of my cases. This author further observed that 27 percent of patients die within 3 years after operation, 36 percent within 5 years, and 56 percent within 10 years; that the mixed-cell type of growth is the most malignant; that the presence of malignant cells in the emissaria of the globe is not necessarily of bad prognostic import (in 58 percent of such cases survival reached 5 years); that the prognosis in cases of extraocular extension is comparatively bad (70 percent of patients died from the disease within 5 years); and that in younger patients the prospect of survival from the disease is better than in those more advanced in years.

The spindle-cell type of lesion with a delicate nuclear structure gives the best and the round-cell epithelioid and the mixed-cell

types the poorest prognosis. Also, the less dense the intercellular reticulum the graver the prognosis, according to Duke-Elder.[1] Their work on the prognostic significance of reticulin, or argyrophil, fibers led Callendar and Wilder[21, 22] to conclude that there is an apparent connection between the reticulin content of the growth and the prognosis. Callender, Wilder, and Ash[15] mentioned an apparent increased lethality with increased pigment content, but withheld a definite conclusion.

Treatment

Once the diagnosis of diffuse malignant melanoma of the iris is established, enucleation without delay is the treatment of choice. This extreme measure is the only procedure that offers relative safety. It would appear that exenteration does not increase the chance of survival in cases of extraocular extension.

There is apparently no evidence to justify radiation as a primary method of treatment. Some authors think it may have value as a postoperative measure.

Case reports

Case 1

History. Dr. A. J. O., a dentist aged 40 years, was examined on June 9, 1945. He complained of photophobia of 6 months' duration and a slight blurring of vision of the left eye of 7 days' duration. He stated that he had had no previous ocular trouble other than an astigmatism, for which glasses were worn, but he thought the left eye had been discolored for several months.

Examination. The vision in the right eye was 20/15, and in the left eye it was 20/20. The right eye was normal in all respects; the iris was light brown in color and without freckles (fig. 1R).

In the left eye, mild ciliary injection, sensitivity to light, and mild edema of the corneal epithelium were present. The aqueous contained a few cellular elements and, with biomicroscopy, the aqueous beam was hazy. The pupil was slightly dilated ovally, but reacted to light in its upper half. The iris was densely pigmented, its color being dark brown, but in its upper segment a few islands showed no pigmentary changes (fig. 1L). Below, there were 3 pigmented nodules rising slightly above the surface of the iris. Biomicroscopy showed dense pigmentation of the iris extending into the filtration angle. On the posterior surface of the cornea there were deposits of pigment. No new blood vessels were noted.

Intraocular pressure was: R.E., 19 mm. Hg (Schiøtz); L.E., 50 mm.

A 2½-percent solution of neosynephrine was instilled twice. The pupil dilated slightly above, but in the lower segment of the iris where pigmentation was heaviest, there was no dilation. The use of neosynephrine for dilation of the pupil was deemed necessary in order to examine the posterior chamber. The ocular fundus was normal; there was no cupping of the optic disc. The fields of vision were within normal limits.

Consultation. The patient was told that in my opinion a malignant melanoma of the iris was present and that enucleation was imperative. Consultation was advised, and he was referred to Dr. A. B. Reese, who, in confirming the diagnosis, wrote me on July 27 as follows:

"I agree most assuredly with you that Dr. O. has a malignant melanoma of the iris of the left eye. I do not feel there is any doubt at all about this. This melanoma is a flat, diffuse type which gives early glaucoma and is sometimes mistaken, particularly in the early stages, for iridocyclitis. I have seen 2 such instances, in which the eyes were operated on for secondary glaucoma. With the gonioscope, I noted the angle over the lower 180 degrees occluded by the tumor tissue."

The patient then returned to me. On August 2nd, the eye was enucleated, and a vitallium sphere was implanted in Tenon's capsule.

Pathologic report. The pathologic report made by Dr. J. A. C. Wadsworth of the College of Physicians and Surgeons, Columbia University, follows.

Microscopic. The sections are from an adult globe in which there is a heavily pigmented tumor of the iris and ciliary body which in its growth has involved the filtration angle (fig. 2).

Near the base of the iris below is a loosely packed, heavily pigmented tumor mass which has spread diffusely throughout the iris and into the ciliary body. The tumor cells with their heavy pigment content can be seen clogging the meshwork of the angle and Schlemm's canal.

On the posterior surface of the cornea near the angle below, a thin layer of tumor cells can be seen extending axialward. Many of these cells contain pigment. Also, scattered irregularly over the entire posterior surface of the cornea are numerous individual implants of tumor cells. Below, the iris is almost completely infiltrated with tumor cells, and those in the stroma of the iris contain no pigment or are very scanty in pigment. The contraction of this infiltrative growth has created a well-marked ectropion uveae.

The tumor extends back from the base of the iris to the base of the ciliary body. In the region of the main mass of the tumor, pigmented cells can be seen coursing along the perivascular spaces into the sclera, but no tumor can be seen outside the confines of the globe in the sections examined.

The majority of the tumor cells are large, oval, and epithelioid in type, and filled with round pig-

ment granules (fig. 3). Occasionally one sees the branching typical of the chromatoblastic type of cell. The numerous implants along the cornea and throughout the iris and into the meshwork of the angle indicate the extreme friability of the tumor, and a marked tendency of the tumor cells to desquamate and disseminate which is typical of the chromatogenic type.

Sections stained with the Wilder method show a moderate amount of reticulum. Sufficient reticulum is present in the tumor to be placed in 2-c according to the Wilder classifications.

In the ciliary body opposite the site of the tumor there are areas of proliferation of the pigment epithelium with an associated proliferation of nonpigmented epithelium.

The retina shows peripheral cystic degeneration, and scattered throughout the retina are numerous small cystic areas. These areas are seen in the ganglion cell layer and external plexiform layer. There is also wrinkling of the internal limiting membrane of the retina.

The choroid is normal except for occasional drusen of the lamina vitrea.

There is moderate cupping of the optic nerve.

Diagnoses. Tumor of iris: melanoma—malignant (disseminating type). Tumor of ciliary body: melanoma—malignant (disseminating type). Glaucoma: secondary to tumor. Ciliary body: hyperplasia of ciliary epithelium.

Course. Recovery was uneventful. When the patient was examined on May 1, 1947, 22 months after enucleation of the eye, there was no evidence of recurrence or metastasis.

CASE 2

History. Mrs. W. L. P., a housewife aged 39 years, was referred to me in consultation by Dr. R. L. McDaniel on May 5, 1944, with the tentative diagnosis of malignant melanoma of the iris of the left eye. She stated that this eye had been red and had ached for 3 days, but there was no history of previous trouble with the eyes. Over an indefinite period of years she had observed the iris of the left eye become dark brown and she had also noticed a dark brown spot on it for many years. The iris of the right eye was blue, with no deposits of pigment.

Examination. On examination, the conjunctiva of the left eye was mildly hyperemic, and there was congestion of the ciliary vessels. Intraocular pressure was: R.E., 19 mm. Hg (Schiøtz); L.E., 40 mm.

The iris of the left eye was uniformly colored a chocolate brown and had the appearance of having had brown pigment spread on its surface. Its normal markings were effaced by the deposits of pigment, and it seemed thicker than usual. The pupil did not react to light; it was slightly dilated and, in the pupillary circle, ectropion uveae was observed. Biomicroscopy showed a slight edema of the corneal epithelium. The aqueous beam was hazy, and within the aqueous fine pigment granules were noted. The filtration angle was covered with pigment over its entire circumference. Fine deposits of pigment were observed on the posterior surface of the cornea and on the anterior capsule of the lens.

A 2½-percent solution of neosynephrine was instilled, but the pupil did not dilate. The ocular fundus was normal except for a pathologic cupping of the nerve head.

The right eye was normal in all respects. The vision in this eye was 20/15, and in the left eye it was 20/20. The field of vision of the left eye was contracted concentrically to 20 degrees for form.

Diagnosis. It was difficult to identify this condition positively as a melanoma of the iris. Uveitis could not be ruled out clinically, nor could glaucoma. A diagnostic iridectomy was therefore performed on May 5th. The pathologic diagnosis was malignant melanoma, and the eye was immediately enucleated (fig. 4).

Pathologic report. The following pathologic report of the enucleated eye was made by Col. J. E. Ash, director of the Army Medical Museum.

Gross. The specimen consists of a firm, rather large eye measuring 26 by 24 by 25.5 mm. There is a scar at the limbus over a coloboma of the iris. The pupil is widely dilated, revealing only a narrow margin of the iris. The eye is opened in the vertical plane. There is a fold at the macula. The optic disc is cupped.

Microscopic. The iris is absent beneath a partially closed scar of a perforating wound of the cornea near the limbus (fig. 5). On the opposite side generally round or polygonal cells, although occasional spindle forms are seen, infiltrate the iris and vascular layer of the ciliary body (fig. 6). On both sides they line the filtration angle, clog the spaces of Fontana, and appear around the canal of Schlemm (fig. 7).

The tumor cells are, on the whole, rather heavily pigmented, but the round, very deeply pigmented cells which cling to the filtration angle and the anterior surface of the iris are probably chromatophores. In the iris the tumor cells are concentrated anteriorly although, in some areas, they penetrate to the dilator muscle. A Wilder reticulum stain demonstrates an argyrophil fiber content of about 50 percent. Subuveal hemorrhage detaches the ciliary body and all but the posterior choroid. The lamina cribrosa appears somewhat depressed.

Diagnosis. Diffuse malignant melanoma of the iris, mixed-cell type, with invasion of the ciliary body; secondary glaucoma; iridectomy; subchoroidal hemorrhage.

The patient was recently examined 3 years after removal of the eye. There was no indication of recurrence or metastasis.

DISCUSSION

In both cases the filtration angle was blocked with pigment and tumor cells, there

Fig. 2 (Richardson). *Case 1.* Photomicrograph showing diffuse infiltration of the iris with tumor cells, extension to the ciliary body, and involvement of the filtration angle.

Fig. 5 (Richardson). *Case 2.* Photomicrograph showing diffuse infiltration of the iris with tumor cells. Insert shows section of the iris removed for diagnostic purposes prior to enucleation of the eye.

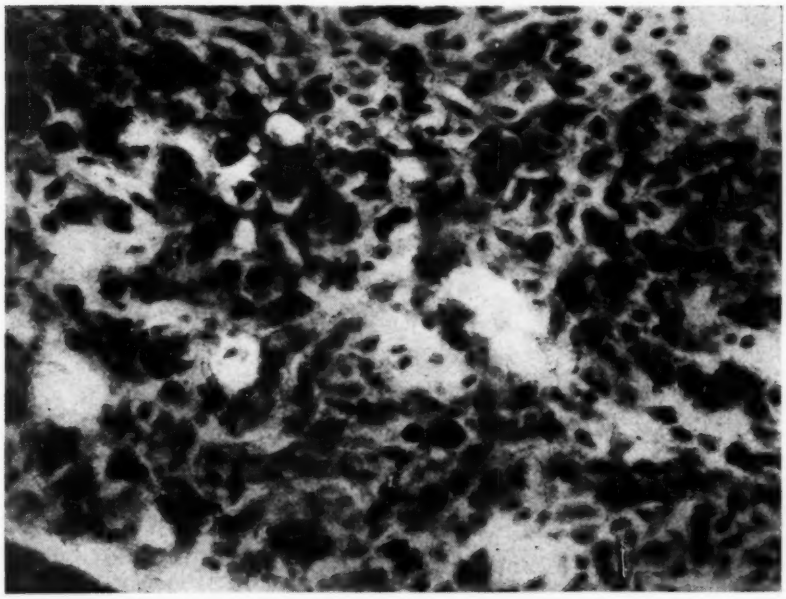

Fig. 3 (Richardson). *Case 1.* Photomicrograph showing infiltration of the iris with heavily pigmented tumor cells (×800).

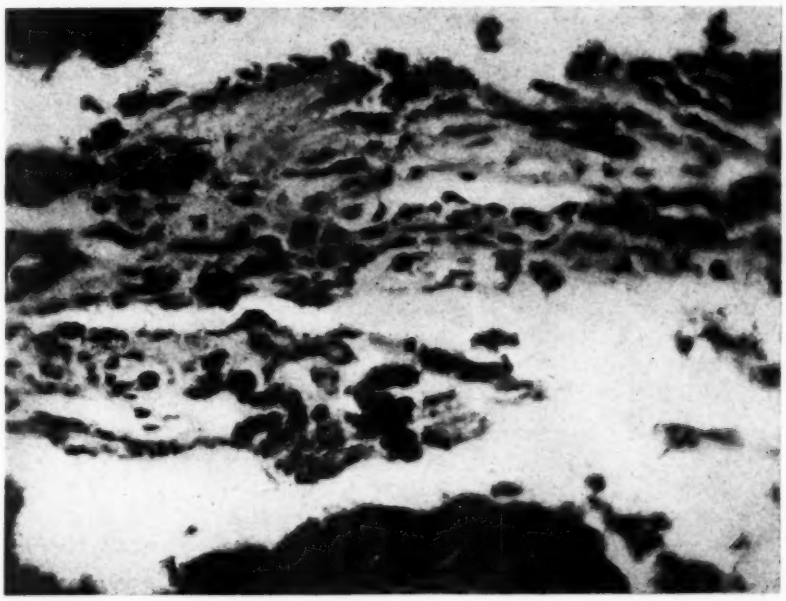

Fig. 4 (Richardson). *Case 2.* Photomicrograph showing section of the iris removed by iridectomy for diagnostic purposes (×800).

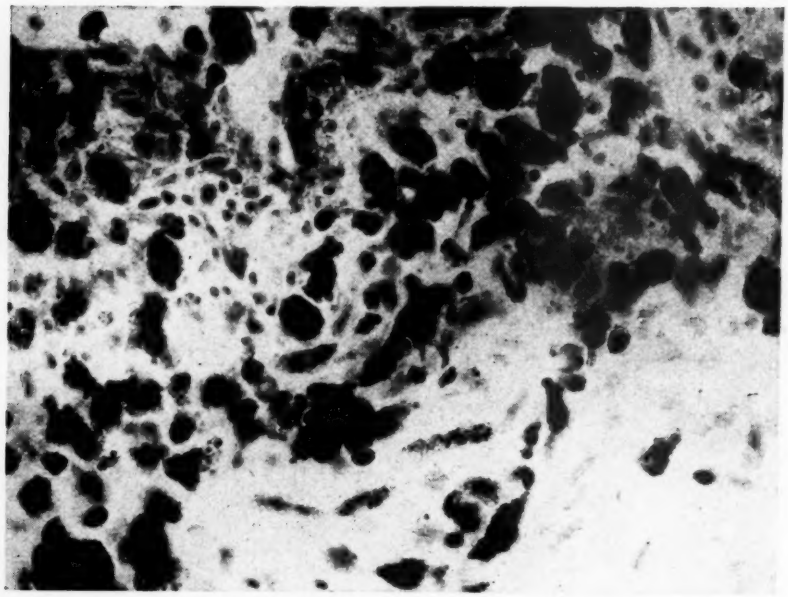

Fig. 6 (Richardson). *Case 2.* Photomicrograph showing infiltration of the iris with tumor cells (×800).

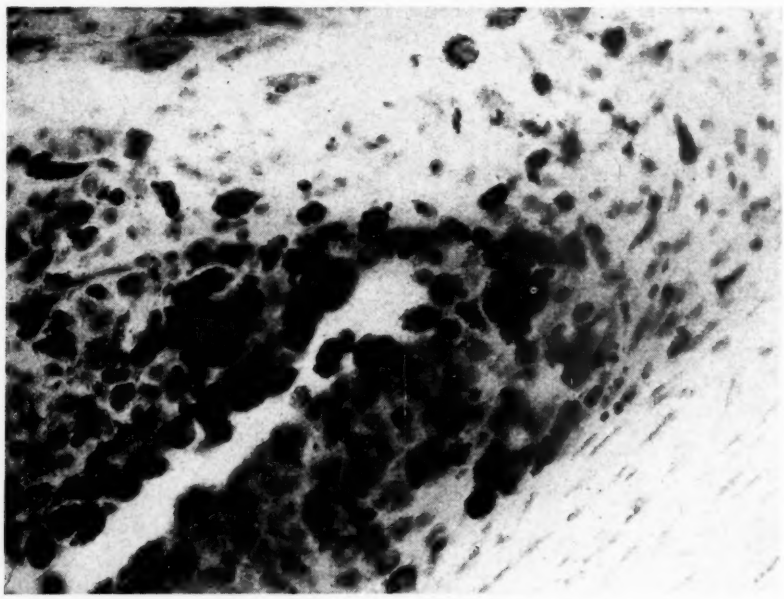

Fig. 7 (Richardson). *Case 2.* Photomicrograph showing section of the iris at the filtration angle.

was secondary glaucoma, deposits of pigment were present on the posterior surface of the cornea, and the anterior chamber was normal in depth. Also, vision was within normal limits in both cases. In Case 1 the pupil dilated only partially and in Case 2 not at all.

Reticulum stain by the Wilder method demonstrated reticulum content of more than 50 percent in Case 1 and about 50 percent in

Case 2. The lesion was of the epithelioid type in Case 1 and of the mixed-cell type in Case 2.

It is noteworthy that in Case 2 a pigmented spot or freckle on the iris of the affected eye was observed by the patient for some years prior to the development of the tumor.

Summary

Diffuse malignant melanoma of the iris occurs rarely. The salient features of this unusual lesion are presented.

Two cases of malignant melanoma of the diffuse type primary in the iris are reported.

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Historical Miniature

Eduard Jaeger, who published the first comprehensive atlas of observations of the eyeground, described a retinopathy similar to albuminuric retinitis which he ascribed to diabetes.

Hirschberg, *Graefe-Saemisch Handbuch.*

THE ELLIOT TREPHINING OPERATION FOR GLAUCOMA*

A PROCEDURE TO MAKE THIS OPERATION LESS DIFFICULT AND MORE EFFECTIVE

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Medical treatment of glaucoma has its limitations and in many cases it fails, at which time surgery becomes necessary. Some eye surgeons even go as far as to advise operation in all cases of early glaucoma.

INTRODUCTION

There are various operations used to reduce increased intraocular pressure, among which are the paracentesis and posterior sclerotomy operations. These procedures afford temporary reductions in tension. Paracentesis of the cornea may be done to lower the tension in the more severe degrees of glaucoma until such time as a more permanent procedure may be safely carried out.

It is dangerous to lower the pressure suddenly in an eye with a tension above 40 mm. Hg (Schiøtz). Therefore, it is recommended that in the morning of a contemplated operation—as for instance a trephining operation—a paracentesis be performed to lower the tension. This is done obliquely through the cornea so that on withdrawal of the keratome the wound immediately seals itself. Pressure on the posterior lip of the wound to permit the aqueous to escape a little at a time gradually lowers the tension. A dressing is applied and by midafternoon the tension will again be up to about 30 mm. Hg or more. The operation can then be carried out with less chance of complications, such as a hemorrhage or a sudden exodus of aqueous carrying a ciliary process into the opening. In a case with a shallow anterior chamber no paracentesis is attempted. A small posterior sclerotomy may be made, or preferably an iridectomia ab externo.

ELLIOT'S OPERATION

The Elliot trephining operation, of late, has seemed to fall more and more into disuse. It has been criticized on the ground of being followed too frequently by secondary infection. In this respect Fuchs[1] remarks, "Statements with regard to secondary infection vary greatly. On the whole it does not seem to occur often if the operation is properly performed."

The incidence of late infections has been variously reported[2] as from none to 13.6 percent. Wilmer[3] came to prefer trephination to all other procedures in glaucoma, and reported 88-percent successes and only one late infection in a series of 107 cases. Of these cases, most were observed for 5 to 15 years. If a tension of less than 18 mm. Hg (Schiøtz) was maintained without the use of miotics and the field and visual acuity remained as good or better than before operation, he considered the operation a success.

If such results can be obtained, the operation deserves more popularity than it enjoys at present. Difficulties in the technical aspects of the procedure seem to explain much of its decline in popularity. Surgeons employing this method complain of buttonholing the conjunctiva, of getting a shelf due to failure to get a clean-cut opening, of difficulty in grasping the iris due to its failure to prolapse, of losing the plug in the anterior chamber, of failure to maintain a reduced tension because of dense scar formation, and of the occurrence of secondary cataract.

MODIFICATIONS IN OPERATION

The object of this paper is to present a simple technique in performing the Elliot corneoscleral trephining operation and to restore this operation to its proper place as a means of relieving tension in glaucoma.

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* Read before the Section of Ophthalmology, New York Academy of Medicine, October 20, 1947.

Benedict's conjunctival flap

Benedict's[4] able paper brought out a proper approach to the limbus. The conjunctiva and Tenon's capsule are cut through, baring the sclera 8 mm. above the limbus. These tissues are undermined right down to the insertion of Tenon's capsule, 3 mm. from the limbus. Here Tenon's capsule is separated from the sclera and the undermining is continued to the attachment of the conjunctiva at the corneoscleral margin. This approach minimizes the trauma to the subconjunctival tissues through which drainage must occur, and makes the wall of the filtering bleb thicker.

Incisions

Attempting to split the cornea is a step where most operators run into difficulty. They make an effort to cut the outer scleral fibers of the corneoscleral margin obliquely with pointed scissors or a sharp dissector and then attempt to split the outer layer of the cornea with a blunt dissector.

The outer layers are not severed and the attempt made to force a spatula into the corneal stroma therefore fails. One small slip and the conjunctiva is buttonholed. The surgeon must then stop and suture this conjunctival tear, or he may enlarge the tear to do a peritomy. When a peritomy has been done the conjunctiva is retracted toward the fornix and away from the limbus exposing the corneoscleral margin.

The trephine is then applied. The cornea about the trephine opening must then be scarified and the conjunctival flap pulled down and sutured to it so as completely to cover the opening. The conjunctiva readily adheres to the scarified cornea around the trephine wound. When simple suturing of the buttonhole is done, the trephine opening may be done to one side of it.

Trephine openings

Trephine openings have been purposely made in the sclera above the limbus. This I do not advocate for two reasons: (1) because this opening is a sclerectomy which may fill with fibrous tissue in about two weeks, and (2) because it places the wound in the apex of the angle of the anterior chamber where the ciliary processes can readily prolapse into it.

Fig. 1 (Meek). Ciliary process from the iris.

Fig. 2 (Meek). Ciliary process from the iris.

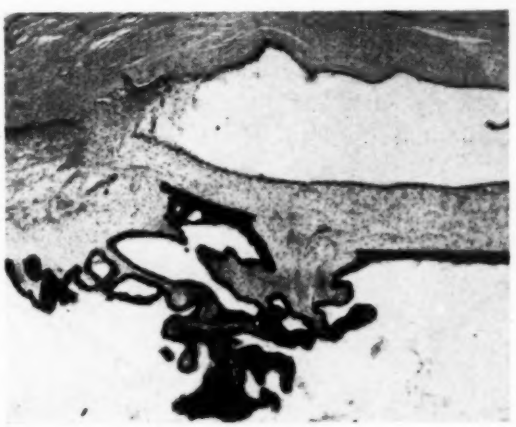

Fig. 3 (Meek). Ciliary process from the iris.

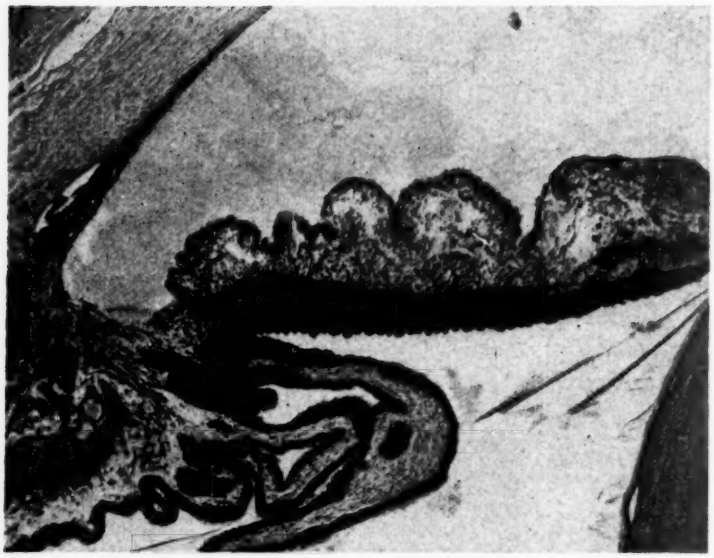

Fig. 4 (Meek). Ciliary process from the posterior surface of the iris root.

Reese[5] has found ciliary processes extending as far forward as the equator of the lens and in some instances has even found them arising from the posterior surface of the iris. This can account for failures with the trephine opening because a ciliary process may block the trephine opening.[6] Placing the trephine opening to the extent of 0.75 mm. in the cornea will reduce the likelihood of such blockage.

In a study of histologic sections of human eyeballs in the Eno Laboratory of the New York Eye and Ear Infirmary, my findings substantiate those of Reese (figs. 1-6).

Technique of new procedure

The method of approach here advocated is to make the conjunctival-Tenon's flap by Benedict's method until the corneoscleral junction is reached. The flap is drawn down over the cornea with a toothpick point covered with wet cotton laying bare the corneoscleral margin.

A Wheeler or Lundsgaard knife is now held lightly between the fingers and thumb. With the blade perpendicular to the surface, the corneoscleral junction is gently sliced until the tissues are half cut through. By so cutting the tissues, the splitting of the cornea is no problem at all. An ordinary iris repositor easily separates the fibers of the cornea. In fact, with very little pressure, the iris repositor may be pushed down between the lamellae as far as one third of the vertical diameter of the cornea.

A 1.5-mm. trephine is used. With about 1 mm. of the cornea now denuded of its outer

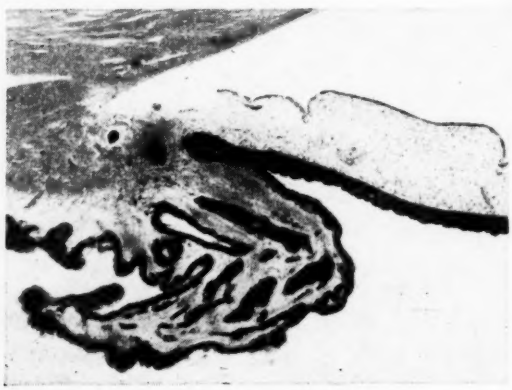

Fig. 5 (Meek). Ciliary process from the junction of the iris and the ciliary body.

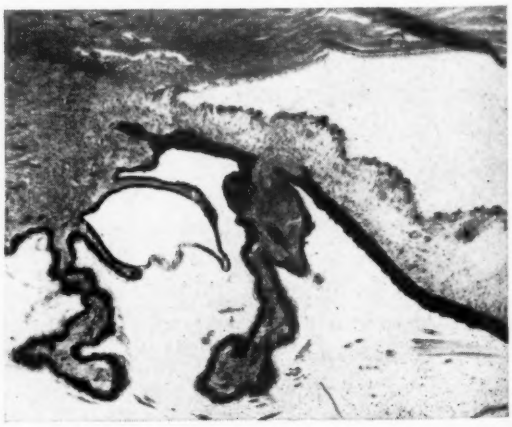

Fig. 6 (Meek). Ciliary process from the posterior surface of the iris.

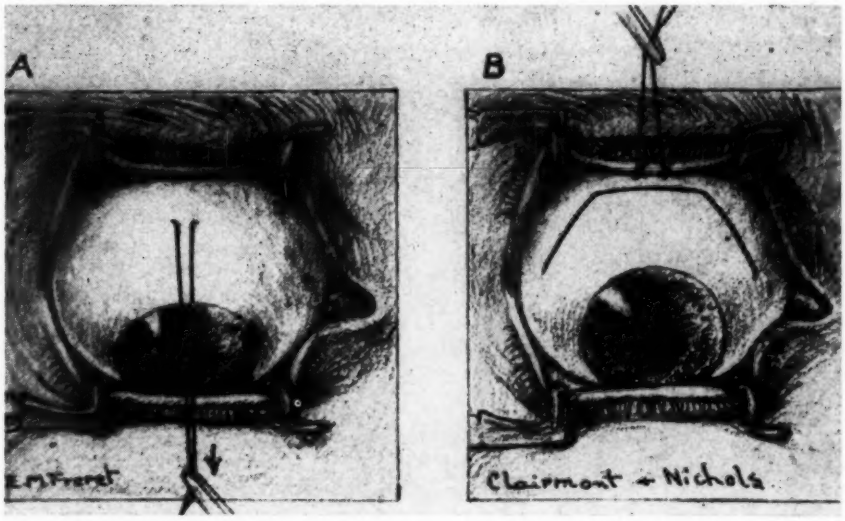

Fig. 7 (Meek). (A) A stay suture is placed in the tendon of the superior rectus muscle. (B) An incision is made with scissors through the conjunctiva and Tenon's capsule down to the sclera.

half, the trephine may be applied above and slid down over the split cornea using the lower raised anterior section of the cornea with its attached conjunctiva as a shelf to hold the trephine in position. In Negroes or highly pigmented persons the cornea is split for a distance of 1.5 mm. from its limbus and, a 2-mm. trephine is used (figs. 7-13).

Gentle rotation of the trephine is now started. The trephine is removed from time to time to be sure that it has not penetrated into the anterior chamber.

Elliot[7] recommended tilting the trephine forward to get a hinge on the corneoscleral disc on its scleral side. Others suggested tilting the trephine back to get an anterior hinge, or to the right or the left side. Such hinges are undesirable because often they form so large a shelf or obstruction that the iris can not prolapse.

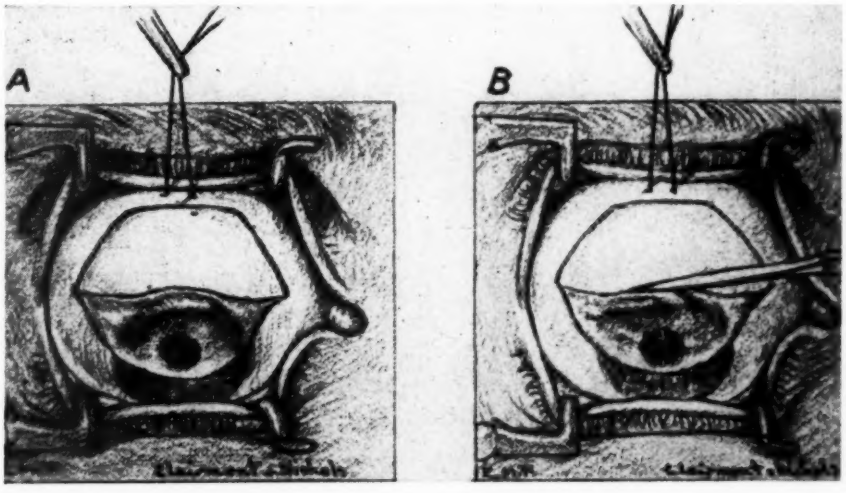

Fig. 8 (Meek). (A) The conjunctiva and Tenon's capsule are undermined down to the limbus. (B) The blade of a Wheeler knife is held perpendicular to the corneoscleral margin.

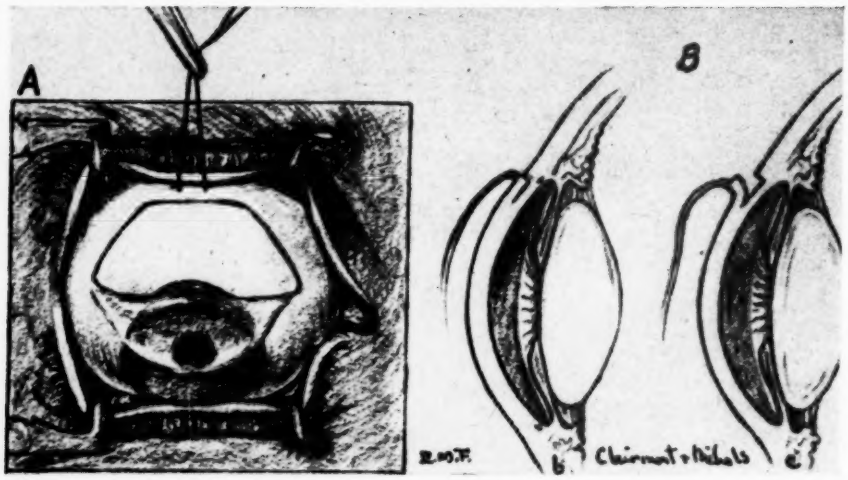

Fig. 9 (Meek). (A) The corneoscleral margin is sliced half-way through. (B) Diagram to show where the tissues are separated by a spatula.

It is best to hold the trephine perpendicular to the corneoscleral margin. With care, a distinct sensation is felt when the trephine penetrates into the anterior chamber. The trephine should then be removed immediately. A trephine with a collar may be used advantageously to avoid penetrating too deeply.

Usually, when the trephine is withdrawn, the iris prolapses at once from the opening, pushing the plug ahead of it. The plug may be removed first if free, and the iris then picked up and incised. If the plug is still adherent, plug and iris are cut together.

In any case, the iris, after being grasped with forceps, must be pushed down toward the center of the cornea so that a broad peripheral iridectomy is performed at the base of the iris. Too often, pulling up on the iris results in an iridectomy down toward or even into the pupil. By pulling the iris axially the ciliary portion of iris is excised to-

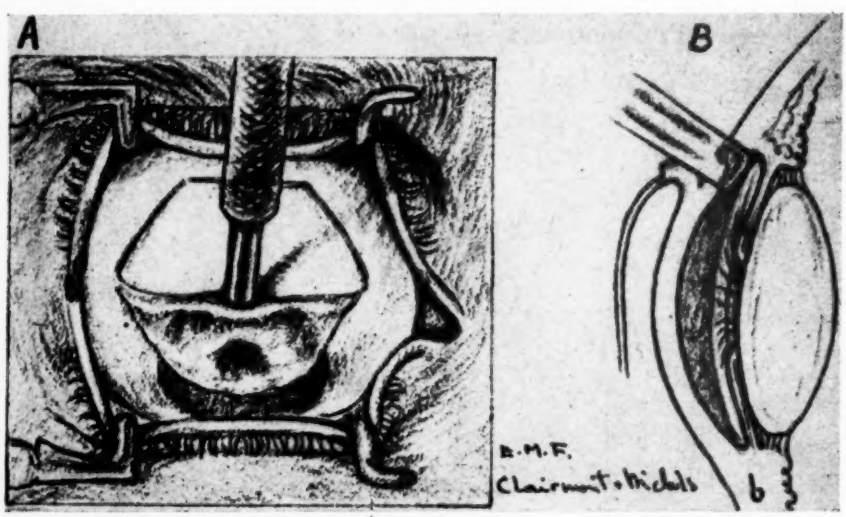

Fig. 10 (Meek). (A) A 1.5-mm. trephine is placed astride the corneoscleral margin. (B) The outer split half of the cornea acts as a shelf to hold the perpendicularly placed trephine.

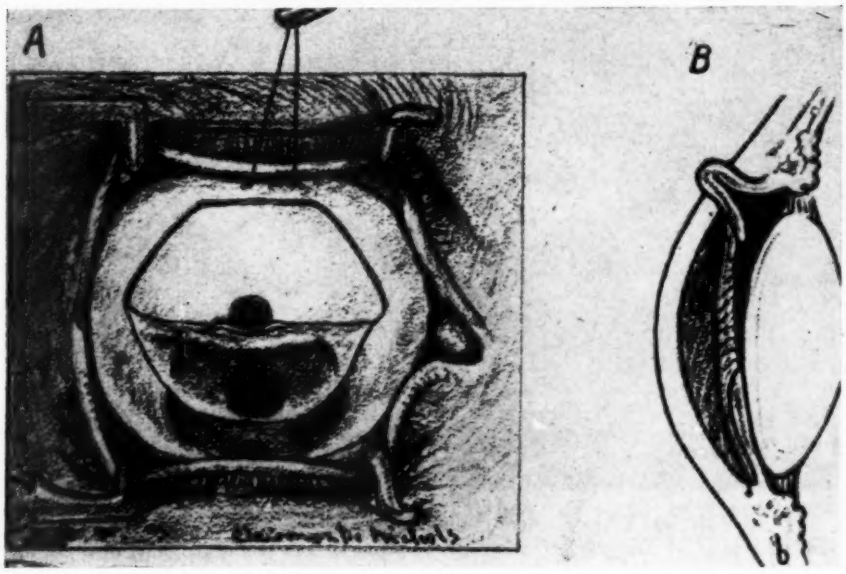

Fig. 11 (Meek). (A) and (B) The iris prolapses through the trephine opening.

gether with any ciliary processes which may be present on the iris. The iridectomy should be wide and deep because it may be surrounded on three sides by ciliary processes. The iridectomy should be sufficiently large to prevent its edges from touching the edge of the trephine opening when the pupil is dilated.

The corneoscleral plug is occasionally lost in the anterior chamber. This is of no consequence and the plug must be severely let alone. In at least two cases I have observed this plug lying on the iris without complications for several years.

If the iris tissue should remain in the opening after the iridectomy, it is easily dislodged by directing a stream of half-normal saline solution into the opening. This must

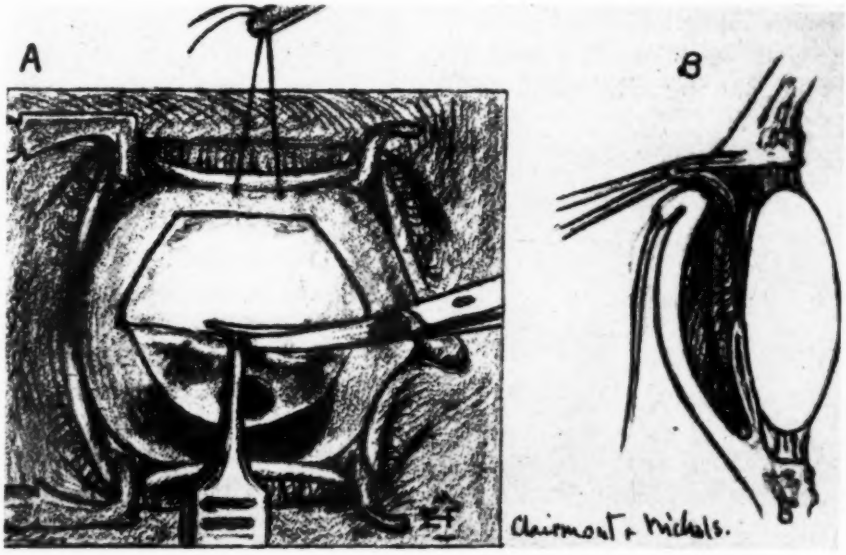

Fig. 12 (Meek). (A) The prolapsed portion of the iris is excised. (B) The iris prolapse is drawn down toward the pupil to get at the base of the iris.

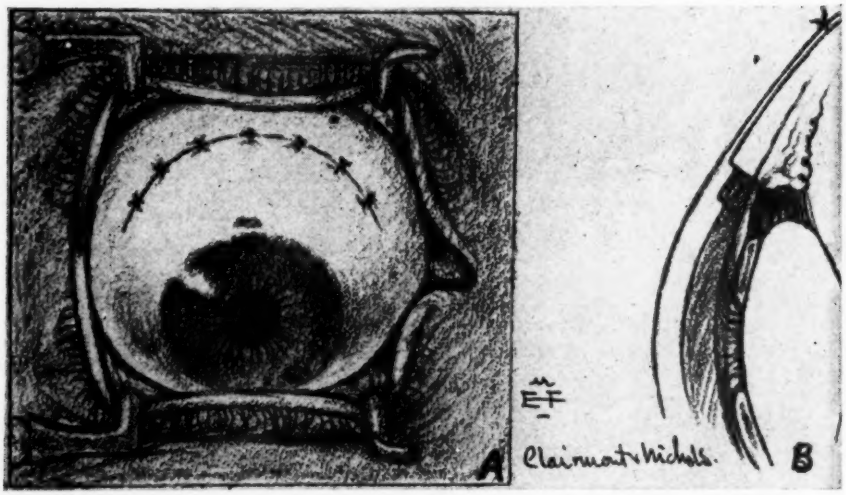

Fig. 13 (Meek). (A) The conjunctival flap with Tenon's capsule is drawn up and sutured. (B) Diagram to show the flap in relation to the trephine opening and why massage is necessary to keep the tissues separated.

be done at once and, if there is bleeding, before the blood clots. The trephine opening must be considered inviolable and no forceps or spatula should enter the anterior chamber.

If the iris does not prolapse, suction may be used, either a Dimitry suction with a lacrimal irrigator or a medicine dropper with a small tip. Disregard of this restriction may lead to damage to the lens, zonule, ciliary body, or anterior hyaloid membrane by misdirected instruments.

Payne[8] in examining enucleated globes in which trephining operations had been unsuccessful found the operative wound closed by dense connective tissue containing fragments of pigment, lymphocytes, and new blood vessels. Verhoeff[9] has described the perfect trephine wound as being filled with delicate connective tissue, full of empty spaces intercommunicating and traversing its extent and free of endothelium. Such a scar can be achieved only by keeping instruments and uveal tissue out of the trephine wound.

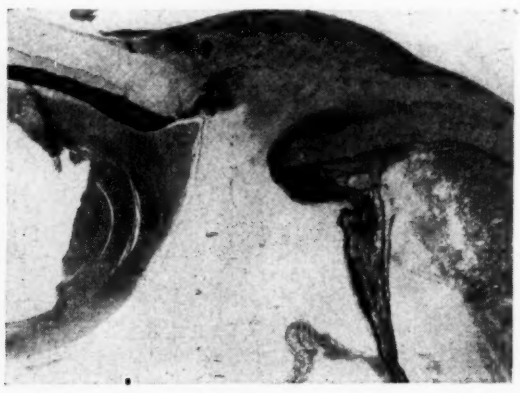

Fig. 14 (Meek). Ciliary process prolapsed into the posterior part of the trephine wound and iris tissue into the anterior part.

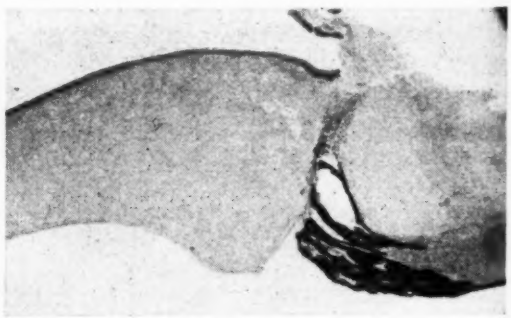

Fig. 15 (Meek). Ciliary process prolapsed into the trephine wound.

The toilet of the trephine wound being completed, the conjunctival flap is drawn up, smoothed back into its former position and the cut edges joined with a continuous plain catgut suture or a number 5-0 black silk suture.

In cases of chronic simple glaucoma with

no congestion or inflammation, a drop of ¼-percent eserine to draw the iris from the trephine wound is instilled. In an eye that shows congestion without definite iritis or

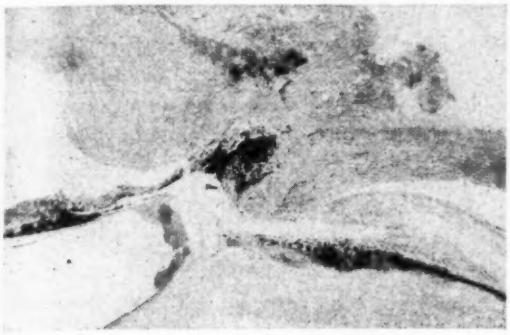

Fig. 16 (Meek). Iris in the trephine wound.

uveitis a drop of 2-percent pilocarpine is instilled. In glaucoma secondary to a uveitis, 1-percent atropine solution may be instilled at the time of operation or, better, at the first dressing especially when eserine or pilocar-

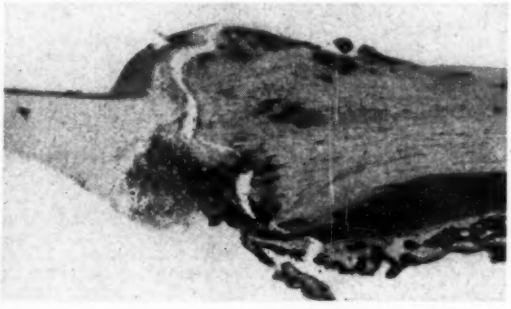

Fig. 17 (Meek). Iris in the trephine wound.

pine have been used. An ointment is applied to the closed eyelids to keep the lashes from sticking to the dressing. In my opinion it is a mistake to fill the conjunctival sac with ointment after any intraocular operation because of the danger of the ointment being drawn or forced into the anterior chamber. The eye is bandaged and may be observed in 24 hours.

A most important step of the operation comes on the third day when gentle massage is begun. This massage is done below the cornea to avoid additional trauma to the flap. The massage helps maintain the filtering

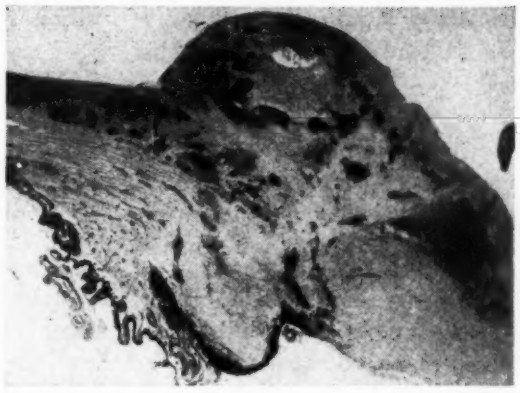

Fig. 18 (Meek). Iris lining the posterior portion of the trephine wound.

bleb and prevents the tissues covering and immediately surrounding the bleb from becoming firmly adherent to the sclera. This

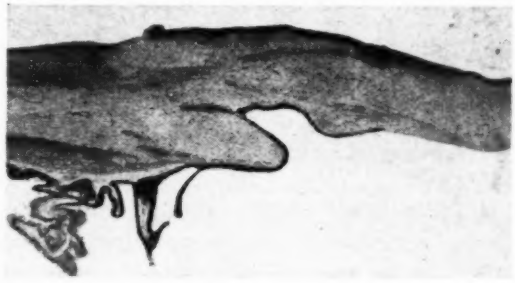

Fig. 19 (Meek). Iris in the wound.

massage should be instituted by the operator himself, for, if care is not used, an intraocular hemorrhage may occur. The massage is continued daily until the wound is healed and the circulation of aqueous established.

Although a filtering bleb is desirable and will usually be achieved by scrupulous technique, the bleb occasionally fails to form or disappears. Sometimes the bleb can be re-

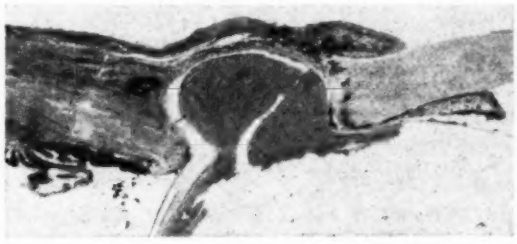

Fig. 20 (Meek). Iris and lens in the trephine wound.

stored by the injection of saline or air into the subconjunctival tissue. Absence of the bleb does not constitute a failure, for even in the absence of an apparent fistula the tension is reduced. Meller[10] states that he has found the tension reduced in 60 percent of such cases. This may be due to the peripheral basal iridectomy. A dressing is kept on the eye for a week.

Comments

From a study of pathologic slides I have found that the causes of failure of the Elliot trephining operation are:

1. The iris is found in the wound in most failures (figs. 14, 16-20).
2. Rupture of the lens with lens fibers in the wound (fig. 20).
3. Ciliary processes in the trephine opening (figs. 14 and 15).
4. Subluxated lens blocking the wound.
5. Hemorrhage.
6. Intraocular infection.
7. Episcleritis.

I have found more failures where iris tissue is caught in the wound than all the other causes put together. In all instances, the wound becomes filled with vascularized fibrous tissue. In every failure one of the above complications was found. The procedure suggested should go far to eliminate these complications.

Summary

A simple method of performing the Elliot corneoscleral trephining operation is hereby presented in the treatment of glaucoma.

Benedict's method of making the conjunctival flap to include Tenon's capsule is used. With a Wheeler or Lunsgaard knife an incision is made at the corneoscleral junction. The knife blade must be held perpendicular to the incision. The corneoscleral margin is sliced to one half its thickness. The cornea is now easily split to a distance of one millimeter. With the trephine placed astride the corneoscleral margin, and using the lower raised portion with its attached conjunctiva as a stop or shelf, the opening is made. The trephine should be held perpendicular to get a clean-cut disc or plug.

The iris tissue, which now presents in the trephine opening, is grasped near its base with iris forceps and, with slight tension pulling the iris toward the pupil, its base is excised. If no prolapse occurs, the iris may be withdrawn by suction.

The conjunctival Tenon's flap is replaced and sutured. Gentle massage below the cornea is begun after the anterior chamber has reformed (usually on the third day) and kept up daily until the wound is healed and the circulation of aqueous established. A dressing is kept on the eye for a week.

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PSYCHOSOMATIC INTERRELATIONSHIPS IN OPHTHALMOLOGY

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With reference to psychosomatic medicine, it has been somewhat facetiously remarked that "any other brand of medicine is veterinary medicine."

Franz Alexander,[1] in a clarification of the question of psychogenesis, gives point to this statement when he says, "The distinctive feature of psychogenic factors such as emotions or ideas and fantasies is that they can be studied also psychologically through introspection or by verbal communication from those in whom these physiological processes take place. An automobile climbing a hill has no sensation of tiredness or of a goal to reach. In contrast to a man-built machine, the organism climbing a mountain has an awareness of certain of its internal physiological processes in the form of effort, tiredness, discouragement, and so on. Moreover, man in contrast to the animal organism is able to convey these internal sensations to others by verbal communication. Verbal communication is therefore one of the most potent instruments of psychology and consequently of psychosomatic research. When we speak of psychogenesis we refer to physiological processes consisting of central excitations in the nervous system which can be studied by psychological methods because they are perceived subjectively in the form of emotions, ideas, or wishes."

OPHTHALMOLOGY AND PSYCHOSOMATIC MEDICINE

Ophthalmology as a medical discipline has not taken kindly to the concept of psychosomatic medicine. The past 20 years have shown revolutionary changes in the study and clinical application of psychology and psychiatry, but ophthalmologists have taken little or no advantage of these changes. They have, on the whole, either ignored this vital stream of new knowledge or have been downright hostile to its development. For example, when the late Dr. Mark Schoenberg[2,3] presented an extremely conservative paper on the therapeutic implications of psychosomatic interrelationships in glaucoma, in 1939, his work was greeted with reactionary jeers or "damned with faint praise" by most of the discussants. When I[4] published an article last year on "Ocular Manifestations of Psychosomatic Medicine," only 15 percent of the 200 requests for reprints came from ophthalmologists.

Perhaps there are several reasons for this attitude. As noted above, verbal communication is one of the most potent instruments of the psychologists. Words are to the psychiatrist what the stethoscope is to the cardiologist; and ophthalmologists are notoriously short on words. There is a precision of diagnostic and therapeutic procedure to ophthalmology which has encouraged too accurate particularization and has led to a conspicuous neglect of such evanescent qualities as psychic factors in ocular disease.

But the concept of psychosomatic medicine is in the ascendancy and its appeal will not be denied. It must be sympathetically studied and understood to be appreciated and no medical discipline can escape its imprint.

Dunbar's[5] very apt definition of psychosomatic medicine should especially appeal to ophthalmology, using as it does the idea of visual fusion. "Psychic and somatic represent merely two angles of observation. Our understanding of disease rests on pictures taken from these two angles viewed simultaneously, united stereoscopically."

In a summary of his views on psychosomatic research, Alexander[1] states that there are fundamental psychologic and physiologic differences between conversion symptoms, vegetative neuroses, and psychogenic organic disease. He suggests that we restrict

hysterical conversation phenomena to symptoms of the voluntary neuromuscular and sensory perceptive systems and differentiate them from psychogenic symptoms which occur in vegetative-organ systems, the functions of which are under the control of the autonomic nervous system.

A conversion symptom is a symbolic expression of a well-defined emotional content, an attempt at relief; although as Freud originally expressed it, these substitutive innervations never bring full relief. The symptoms express at the same time both the repressed emotion and its rejection. Because they do not fully relieve the tension, we have a pathologic condition.

A vegetative neurosis such as emotional hypertension is not an attempt to express an emotion but is the physiologic accompaniment of constant or periodically recurring emotional states. The chronicity of an emotional tension alone is what makes such a condition morbid.

Ocular disturbances of psychogenic origin

In considering ocular disturbances of psychogenic origin it would seem rational to divide them as follows:

I. Ocular conversion symptoms

1. Blepharopasm
2. Convergence spasm
3. Asthenopia
4. Photophobia
5. Hysterical amblyopia and amaurosis

II. Ocular vegetative neuroses

1. Ciliary spasm
2. Amaurosis fugax
3. Central angiospastic retinopathy
4. Migraine
5. Glaucoma

These are the more common ocular disturbances of psychogenic origin which will be discussed here. That there are others, I am aware, especially in the vegetative neurosis group. These will require further psychosomatic research for their proof.

Ocular phenomena of conversion hysteria

There is hardly a sign or symptom of organic disease which hysteria cannot simulate. While there have been many published articles on the subject of ocular hysteria, the majority of cases are diagnosed per exclusionem. After a thorough ocular examination has failed to reveal an organic cause for the visual loss, the condition is labeled "hysterical" by virtue of the purely negative result. Seldom is any attempt made to determine in a positive sense the existence of hysteria, an absolute necessity for both adequate diagnosis and rational therapy.

Blepharospasm

This symptom may vary from the transient "blinking" of a nervous child to the most severe and constant spastic closure of the lids. One of the most common of all ocular complaints in children, especially in the early school years, is a frequent, nervous "blinking" tic, which starts as a hardly noticeable increase in frequency of the normal wink reflex and becomes rapidly worse until it is noticed as an actual grimace by the parents or the school nurse. Many of these children are brought to the ophthalmologist for examination with this as their only symptom. In the majority of instances they are refracted and a pair of glasses prescribed in the hope that relief from a minor eyestrain will relieve the symptom.

It is true that an occasional case of this type will be found to have a considerable degree of uncorrected refractive error with secondary chronic conjunctivitis and consequent lacrimation and irritation leading to the development of the symptom, but in most instances the disturbance is purely psychogenic in origin. A careful history from the mother, with some sympathetic questioning and coincidental observation of the child, will reveal a background for conver-

sion hysteria of a mild character that can hardly be doubted.

The symptom may have started "after a severe scolding," "after a school-yard fight with a bigger boy," "after a severe fright by a dog." These are manifestations of a "shrinking from danger" where "squinting" or closure of the lids is a natural protective reflex. Often the symptom is first noticed when the child begins "audience reading" in school. The more difficulty the child has in learning to read, the more he stumbles and gropes for words, the more apt is he to develop obvious signs of anxiety, increased nervous tension, stuttering and stammering, and finally blepharospasm. This attempt at escape from a difficult situation is a typical example of a conversion symptom in hysteria.

From this mild form of "nervous tic," it is only the degree of severity and the duration of the hysteria which produce the elaborate muscular twitching of the orbicularis oculi and the grimacing spasm of the entire face that may finally result in the constant, spastic closure of the lids seen with relative infrequency in the adult.

To attribute these phenomena to eyestrain, refractive error, uncorrected phorias, and the like, as is frequently done, is manifestly improper. Even to make the diagnosis by exclusion of organic disease is a negative approach. One must, by proper psychiatric evaluation, establish the positive diagnosis of hysteria before treatment, if it is to be successful, can be based upon an exploration of the subconscious for an adequate explanation of the repression responsible for the symptom.

Convergence spasm

This is perhaps one of the most clearly defined ocular motor anomalies which may occur as a symptom in conversion hysteria.

Souders[6] reported a case of this type and briefly reviewed the rather meager literature. He states that the disturbance represents an excess of convergence usually associated with a comparable excess of accommodation which becomes pathologic because of its duration in a susceptible psychoneurotic patient.

In these cases, ample evidence of a psychogenic background is offered but again the diagnosis is made by exclusion of organic disease, and therapy by persuasion and counter suggestion is declared unsuccessful.

It is suggested that, in severe cases of long duration, one is not justified in pronouncing them incurable until all the possibilities of prolonged psychoanalysis have been explored. I have seen two cases of severe convergence spasm, associated with hysterical amblyopia, promptly cured by sodium-amytal narcosis followed by brief psychoanalytic therapy. Both were acute cases of short duration, and both were diagnosed by a positive psychologic approach to the hysteria rather than by negative exclusion of organic disease.

Asthenopia

This has become a waste basket of the eye symptomatology and has been used to describe everything from unclassified headache, photophobia, and eyestrain to amblyopia of psychogenic origin. Numerous articles have been written decrying the practice of prescribing glasses for eyestrain when an analysis of the patient's psychic background would have speedily revealed the real cause of his trouble.

Derby[7] believed that "ophthalmologists produce more neurosis than they cure. Too often the neurotic patient is dismissed with a minor change in his prescription, when what he really needs is a careful analysis of his condition and an explanation of how his various aches and pains should be interpreted and treated." Derby would like to see the word "eyestrain" banished from our vocabulary and states that "if the general public could learn that eyes are seldom strained, this would be a happier world to live in."

Rutherford[8] identifies asthenopia as a psychoneurosis "to distinguish it from simple eyestrain," and becomes considerably confused himself in the process. In the discussion which followed this paper, Lancaster called attention to the rule that a psychoneurosis should never be diagnosed on negative evidence alone.

Asthenopia, like all forms of conversion hysteria, is extremely susceptible to cure by suggestion but, only by being constantly alert and interested in the subject can the ophthalmologist avoid the common pitfall of temporarily curing a symptom while completely neglecting its cause. The prescription of a pair of glasses, no matter what their dioptic power, may result in immediate relief of eyestrain, headache, blurring of vision, and the like. Without a true analysis of the underlying cause and its treatment by psychotherapy, however, no more than a transient improvement, at best, can be expected.

Photophobia

In the absence of organic pathologic conditions, particularly intraocular inflammation and keratitis, the most common cause of photophobia is psychogenic.

Inman[9] states that "nearly every person who complained of glare or bright light, whether natural or artificial, had either definite fear of the dark or could remember his struggles to get rid of this fear when a child."

The complaint of photophobia was an extremely common one in the Armed Services during the war and has been reported by me.[10] It is usually a minor disturbance, frequently only a part of a more complicated conversion-hysteria symptom complex, but may reach such proportions as to be a disabling disorder in its own right. It is markedly increased by fatigue and by anxiety and emotional stress.

The exclusion of irreversible disease in severe photophobia is not difficult, but even more important in establishing the psychogenic origin of the symptom is a careful analysis of the patient's history and personality pattern. There is a frequent association of photophobia with blepharospasm, facial tic, and transient amblyopia from ciliary spasm. These associated symptoms and the photophobia itself can often be abolished by direction of the patient's attention away from his symptoms.

A typical example of severe and disabling photophobia was reported by me in the case of an aviation cadet who developed such anxiety over failure to pass his Morse code blinker-light signal test that, in an unconscious attempt to escape from an intolerable situation, he transferred his fear of failure to a fear of the light itself. When the psychogenic nature of the disturbance was understood by the patient, he was able to overcome his difficulty, qualified for advanced flight training, and the photophobia disappeared.

Hysterical amaurosis and amblyopia

There is a vast literature on the subject of hysterical blindness. The majority of articles, however, deal with individual case reports of hysterical amblyopia in which the diagnosis of the psychogenic nature of the disturbance has been made by the purely negative method of exclusion of organic disease. Many authors make reference to an "intolerable situation" as a factor in the production of the amblyopia, but almost none of them make any attempt to explore the nature of the psychic factors which alone will explain the raison d'etre of any individual case. Little attention has been paid by ophthalmologists to Freud's[11] comprehensive discussion of psychogenic visual disturbances in the light of psychoanalytic knowledge.

To quote Dunbar,[5] "To consider the numerous and peculiar ocular neuroses as disease entities is not permissible. It is not only that, in addition to the neurotic eye symptoms, there are always neurotic symptoms in other bodily spheres, but also that the neurotic symptom is always merely the ex-

pression of a psychic conflict in the total personality. It is with this total personality and its situation that we have to deal. Confronted with a neurotic amaurosis, we must deal, not with this, but with underlying disturbance in psychic equilibrium, if we are to understand the symptom and the necessary course of treatment. There is always a conflict out of which the neurotic individual finds no other way than that of flight into illness, which is itself an attempt at cure, even though unsuccessful. Persuasion and suggestion can at best eliminate a symptom. The deep sources of the neurosis are reached only by psychoanalysis."

It is not advocated that ophthalmologists should attempt to psychoanalyse their patients, but a study and appreciation of psychology is essential to intelligent coöperation with the psychotherapist.

Amblyopia is a much more common symptom of conversion hysteria than amaurosis. In the majority of cases in which the amblyopia is the dominant symptom, there are, however, other complaints and symptoms which can be readily uncovered by psychiatric evaluation and which fit into the picture of hysteria.

A recent article by Yasuna[12] reports 15 typical cases of hysterical amblyopia in men about to be discharged from the Army. All of the classical symptoms are demonstrated, including the resigned attitude of the patient to his disability; the slow, hesitant reading of the Snellen test chart, no matter what letters were chosen as minimum visual acuity by the patient; the typical tubular, sharp margined, visual fields found in almost all cases; and the marked amenability to suggestion resulting in rapid improvement in vision with only the most superficial psychotherapy.

Yasuna points out that while monosymptomatic hysteria is not uncommon, the greatest number of cases present a variety of manifestations and that the acute type in which the amblyopia develops suddenly is relatively uncommon. Most of the cases belong in the chronic groups in which no definite time of onset can be fixed; and the course is complex or of the mixed type, in which other elements of psychoneurosis are also present and frequently are the more obvious factors in the individual.

It is generally agreed that suggestion plays a most important part in the treatment of hysteria,[13,14] but it must be emphasized again that the transient "cure" of a symptom by suggestion is by no means a cure of the underlying psychogenic factors producing the symptom. Cure by suggestion, therefore, is of more value as a diagnostic procedure than as a rational form of therapy. Frequently, and especially in children, the complicated routine of a careful ocular examination carries so strong an element of suggestion that, during the procedure, the vision shows distinct improvement, and the correct diagnosis is thus established.

Lastly it must be remembered that the amblyopia of conversion hysteria may be superimposed upon a visual disturbance with an organic basis. I have recently established such a diagnosis in a patient with an extreme colloid degeneration of the choroid. The appearance of the fundus suggested the possibility of considerable loss of visual acuity, and the patient had been accepted as blind to the extent of receiving a large monthly pension and a seeing-eye dog. He had lectured before numerous groups on the opportunities and occupations open to the blind and was running his own successful dairy farm. His vision was reduced to light perception. Associated with his amblyopia, however, were other symptoms, such as severe photophobia and blepharospasm, strongly suggestive of the psychogenic nature of the disturbance. A careful psychiatric evaluation of the total personality of the individual revealed a pattern which left little doubt of the real nature of the disability. Improvement of vision to 20/20 with normal visual fields by suggestion and psychotherapy, further confirmed the diagnosis of hysterical amblyopia. The eventual cure of this pa-

tient's underlying psychoneurosis will be a most difficult problem. Cases of this sort demand the closest coöperation and understanding between the ophthalmologist and the psychiatrist.

Ocular vegetative neuroses

This is one of the most fertile of all fields for psychosomatic research. As noted above, a vegetative neurosis is not an attempt to express an emotion but is the physiologic accompaniment of a constant or periodically appearing emotional state.

There is ample anatomic and physiologic evidence of the cortical control of the vegetative nervous system through the hypothalamus.[31]

In a very comprehensive review of the experimental data on the anatomy and physiology of the hypothalamus, Ingram[15] conservatively concludes that the evidence clearly indicates that this portion of the brain contains important integrating mechanisms for the so-called vegetative functions. Many of these mechanisms produce their effects by influencing lower, subordinate complexes. In turn, the hypothalamus is undoubtedly under a certain measure of control by higher regions, including the cerebral cortex.

In a lengthy and well-documented article on hypothalamic function in psychosomatic interrelations, Grinker[16] concludes that "as a cephalic representative of the autonomic nervous system, the hypothalamus has to do with the energies of visceral origin which are the forces of the instincts."

Bard[17] was able to show conclusively that a central autonomic center resided in the hypothalamus and that there is also a direct inhibitory effect exerted on the hypothalamus by the cerebral cortex.

More recently Kennard[18] has correlated autonomic interrelations with the somatic nervous system and found that anatomic and functional interrelations between the autonomic and somatic nervous systems can be demonstrated at many levels; that emotions are known to produce responses in both autonomic and somatic nervous systems; and that these interactions take place chiefly within regions containing the extrapyramidal representation in the forebrain.

From an ophthalmic point-of-view all of this is simply evidence for the cortical or emotional control of the vasomotor system since most of the ocular vegetative neuroses are primarily vasomotor disturbances.

Ciliary spasm

This is, perhaps, the single exception to the foregoing statement. The action of the autonomic nervous system on the pupillary constrictor and dilator fibers and on the ciliary body is well known and has been reviewed by Cogan.[19] Many authors have called attention to the dilation of the pupils in both animals and human subjects under conditions of emotional stress, such as rage and fear.

Since the days of Helmholtz accommodation for far vision has been considered to be a passive process, the ciliary muscle being relaxed; while the accommodation for near vision is said to be an active process, the ciliary muscle being in a state of contraction.

Several authors have questioned the validity of this theory and Olmstead,[20] on the basis of careful animal experimentation, flatly states that "both divisions of the autonomic nervous system can act on the lens; that the influence of the sympathetic is in the direction of hypermetropia, and the parasympathetic in the direction of myopia; that there is a tonic action of both divisions of the autonomic nervous system, since removal of either leads to permanent dioptric change; that the radial fibers can act in groups; and that the same general picture resulting from sympathetic stimulation is shown in man as well as in lower mammals."

Relatively little has been written regarding the production of transient myopia by emotional disturbance such as fear or anxiety states, and yet it is a relatively common phenomenon and one which must be familiar to most ophthalmologists.[13]

The disturbance is limited to young people and manifests itself as a periodic and transitory blurring of distance vision usually associated with prolonged reading. There is often a sensation of ocular fatigue or even fairly severe pain and the visual loss may vary from slight to as low as 20/200, and may last from a few minutes to days or even weeks at a time. The change in refraction may vary from 0.50D. to as much as 2.0D. by manifest refraction and is characteristically altered by rest or by employment of the "fogging" method of refraction. The use of homatropine as a cycloplegic immediately abolishes or reduces the dioptric change, but this improvement is only temporary and the symptom becomes manifest as soon as the effect of the cycloplegic wears off. Ciliary spasm is differentiated from amaurosis fugax by the measurable change in the refractive power of the eye, but it must be remembered that both conditions may occur in the same eye.

A careful analysis of the histories of these patients will reveal a definite and sometimes severe anxiety state, and it is only by analysis of the psychogenic factor that a cure can be accomplished.

A typical example of ciliary spasm is seen in the young student who is on the verge of failure in school. Because of his poor scholastic ability he is forced to spend more than the average amount of time in study. His anxiety over his incipient failure causes him to work under more and more pressure until a vicious circle of more reading and greater anxiety results in a spastic myopia of greater or less degree.

I have found this disturbance quite frequently in medical students and it was extremely common in preflight and basic training schools in naval aviation in the last war. Here the consequences of failure, loss of the coveted wings and a commission in the Air Corps, had a correspondingly strong psychogenic factor.

Whether one adheres to the Helmholtz theory of accommodation or to the newer theories of dual autonomic innervation of the ciliary muscle does not alter the basic fact that this disturbance is a vegetative neurosis—the physiologic accompaniment of an emotional state.

Amaurosis fugax

This symptom complex differs from ciliary spasm in the absence of measurable dioptric change in refraction. It is a true vegetative neurosis which is vasomotor in origin and, as reported by me,[4, 21] differs only in the matter of degree of vasospasm from central angiospastic retinopathy, to be discussed later. It includes all those ocular disturbances, such as periodic dimness of vision and black out, which are associated with autonomic instability but leave no permanent or visible organic change. It is frequently a part of the symptom complex of neurocirculatory asthenia.

The chief complaint is of periodic visual loss which varies from transient fogging of vision to complete "black out lasting for 30 to 60 seconds and identical with the black out described by aviators at the termination or pull out of a power dive. The frequency and severity of the amaurosis may be so severe as to be actually incapacitating, but exhaustive ocular examination reveals no evidence of organic disturbance sufficient to account for the symptoms.

Even casual observation will reveal, in most cases, other evidences of vasomotor instability, notably an increased sweating of the hands, tremor of the fingers, and poor peripheral circulation with blanching of the fingers when the hands are held above the head and cyanosis when they are dependent.

Careful evaluation of psychogenic factors will always reveal marked anxiety state, frustration, fear, excitement, or homesickness, and treatment must be directed to these causative factors.

Central angiospastic retinopathy

This is the term applied by Gifford and Marquardt[22] to a type of macular retinal

lesion which they felt to be definitely of circulatory origin. They and Horniker,[23] Bailliart,[24] and I[21] have established evidence of general vasomotor instability in these cases and demonstrated the vasospastic etiology of the disease.

A large number of cases of central angiospastic retinopathy were reported in the Armed Services during the last war and I have seen a number of cases in the past year.

Visual disturbance is usually sudden in onset and may be quite severe with central vision reduced to 20/200 or less. The condition may be unilateral but is more frequently bilateral. Visual fields show a central scotoma of varying size and density. There is frequently a complaint of distortion of objects or metamorphopsia.

Examination of the fundi in the acute stage of the process shows a definite grayish edema of the macula with loss of foveal reflex and a generally smudged appearance of the macula. One of the earlier names for the condition was descriptive of this stage of the process—central serous detachment of the retina. As the edema subsides, the macula takes on a mottled, granular appearance due to redistribution of the retinal pigment. The absence of the foveal reflex persists. The vision may improve markedly but seldom comes back to its previous acuity.

A large number of cases show, in their final stage, a minute, sharply outlined, irregular hole in the fovea with a corresponding minute central scotoma and vision of 20/30 or 20/40. These macular holes are difficult to see but, with adequate illumination and especially with red-free illumination, they are usually quite visible when searched for.

In searching for the etiology of this condition, the only constant etiologic factor in nearly 100 cases seen by me[21] was autonomic instability and excessive stimulation of the vegetative nervous system. Practically all cases studied showed definite clinical evidence of vasoneurotic diathesis with hyperhidrosis, cyanosis or pallor of the finger tips, and deficient peripheral vascular systems as manifested by abnormal skin-temperature readings of fingers and toes.

Psychiatric studies have revealed almost uniform anxiety states, often of considerable severity. Even in peace time the psychosomatic aspects of the disturbance are quite evident to fairly casual study. Zeligs[25] has approached the subject psychosomatically and has pointed out the occurrence of anxiety as a common type factor in the production of central angiospastic retinopathy. It is realized that any autonomic stimulus of sufficient severity and duration can produce this condition but the most common stimulus is psychic trauma.

This is a classical example of a severe vegetative neurosis with associated physiologic disturbance of such intensity and duration as to become irreversible. The end result is an organic pathologic condition.

Migraine

While the visual disturbances associated with migraine are primarily cerebral in origin, the ocular symptoms are of so dominant a nature that a large percentage of sufferers first consult the ophthalmologist, and it is surprising how few ophthalmologists have a sympathetic understanding of the disorder or can even recognize its symptoms. A complaint of headache, if carefully analysed, will frequently reveal associated visual disturbance, slight or severe nausea, an aura which may vary from a vague sense of depression to an outstanding burst of physical energy, and a postheadache period of lassitude or mental sluggishness. These are the symptoms of migraine and they vary tremendously in intensity and duration. Further inquiry will almost always demonstrate a period of tension, anxiety, frustration, or other psychic trauma preceding each attack. The association of peptic ulcer with a migrainous history is too common to be mere coincidence.

I have observed two cases of severe migraine over a considerable period of time in which I could easily demonstrate visible

vasoconstriction in the retinal arterioles during the aura preceding the attack and continuing on into the period of preheadache hemianopia. In numerous other instances I have found overwhelming evidence of emotional disturbance and I am completely in agreement with Wolff's[26] observation that subjects with migraine show certain typical personality features and reactions. It has been my observation that most migrainous patients show strong evidence of a vasoneurotic diathesis. Most of them are overly conscientious. They accept responsibility but only at great cost to their peace of mind. They often suffer from insomnia. The incidence of migraine is greatly increased during periods of stress, notably during the last war.

It is now, I believe, generally accepted that migraine is a vasospastic disorder; that the preheadache scintillating scotoma and homonymous hemianopia occur as the result of a severe cerebral vasospasm, and that the compensatory vasodilation produces the headache.

Even the somatists, with their elimination diets, have come to feel that the allergic reaction is a vasomotor one, and those who are using the trypan-red, vital, staining-dye method of treatment concede that its action is to lower vasomotor tone.

Psychiatric treatment of migraine subjects is admittedly difficult but, if the condition is recognized as a vegetative neurosis, much progress will have been made toward its relief.

Glaucoma

This is one of the most fascinating of all subjects from the standpoint of psychosomatic interrelationships in ophthalmology.

The importance of the psychic factor in glaucoma is recognized by every ophthalmologist. Many authors[2, 3, 27, 28] have cited instances of psychic precipitation of single attacks of acute glaucoma and almost every ophthalmologist can duplicate these case histories from his own records.

If it is assumed that attacks of acute glaucoma may be precipitated by psychic shock, is it not also possible, as suggested by Sussmann,[29] that the latent disposition toward glaucoma has its causal basis in the unconscious life?

More and more evidence is being accumulated to show the close relationship between the intraocular vascular circulation, the secretion of the intraocular fluid, the level of intraocular pressure, and their control by autonomic nervous system.

As has been pointed out above, our present knowledge of the anatomic and physiologic connections of the autonomic nervous system with the higher cerebral centers through the hypothalamus makes it logical to assume a direct effect on intraocular pressure by these higher centers. Certain it is that there are many aspects of glaucoma which cannot be explained by the purely mechanical theories of aqueous drainage.

In an extremely interesting recent study of personality patterns in 27 selected cases of primary glaucoma Hibbeler[30] has demonstrated that more than two thirds of the patients showed marked deviations on one or more of the personality scales as measured by the Minnesota Multiphasic Personality Inventory. In many instances, the personality deviations were so severe as to suggest behavior bordering on the psychotic.

Schoenberg[2, 3, 31] contended that the eyes of some patients with glaucoma registered states of anxiety which acted as a precipitating factor for the development or maintenance of a high intraocular pressure. He argued from this that some of the glaucomatous crises are therefore preventable by proper attention to the patients' emotional life. He stated that ophthalmologists must familiarize themselves with the fundamentals of psychoanalysis and psychotherapy and must become interested in the personality problems of their patients, and that a somatic diagnosis without a survey of the patient's emotional life is an incomplete diagnosis.

I am in complete agreement with these statements of Dr. Schoenberg, although I believe he was somewhat conservative in limit-

ing his thesis to the precipitation of glaucomatous crises in previously glaucomatous eyes by anxiety states. It is my belief that chronic emotional disturbances may play a definite part in the progress of a primary glaucoma without reference to congestive failure or crisis.

For this view I anticipate criticism and repeat my statement from an earlier paper,[4] "It is not my purpose to advocate the thesis that glaucoma is a purely psychosomatic disorder or to prefer psychotherapy over all other forms of treatment in glaucoma. I feel, however, that psychic trauma may be an important causal factor in many cases of glaucoma and that its recognition will lead to a more rational and complete therapy of the disease."

Summary

Ophthalmologists have not appreciated or availed themselves of the recent advances in psychodiagnosis and psychotherapy as they apply to their specialty.

The fundamental differences between conversion symptoms and vegetative neurosis are discussed.

The following ocular disturbances of psychogenic origin are described and discussed.

I. Ocular conversion symptoms
1. Blepharospasm
2. Convergence spasm
3. Asthenopia
4. Photophobia
5. Hysterical amblyopia and amaurosis

II. Ocular vegetative neuroses
1. Ciliary spasm
2. Amaurosis fugax
3. Central angiospastic retinopathy
4. Migraine
5. Glaucoma

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THE INFLUENCE OF TORSIONAL MOVEMENTS ON THE AXIS OF ASTIGMATISM*

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A number of recent publications[1-3] dealing with changes of the axis of astigmatism have aroused new interest in this problem. These changes concern either those resulting from effort to maintain fusion for distance or those brought about by convergence. The present investigations were undertaken with the former changes in mind, and a simple method of examination will be suggested. However, in order to evaluate this problem in its true perspective, it seems appropriate to scrutinize the complex mechanism of torsional movements of the eyes. Only by recapitulating the physiologic principles involved is one able to draw any conclusions as to the importance of the relatively small part that the abnormalities in question play.

A number of coördinated movements of the eyes that can be performed voluntarily can be differentiated. There are two main groups, the conjugate and the disjunctive movements. To the former group belong levo- and dextroversion, elevation and depression; to the latter, convergence and divergence. A number of movements should be added that can be performed under certain conditions only, and that cannot be called voluntary per se: Abduction and adduction (or prism divergence and convergence), and supra- and infraduction (sursum- and deorsumvergence). All these movements can be performed from the primary position. Rotations around the transverse axis involve the "angle of altitude," those around the vertical axis are relative to the "angle of azimuth." Movements around these axes are referred to as "cardinal movements," and the positions reached as "secondary positions." The eyes are not restricted to cardinal movements, and can be rotated in any oblique meridian. But, in any event, they will have to rotate around an axis that is perpendicular to the line of fixation, as formulated in Listing's law: "When the line of fixation passes from its primary to any other position, the angle of torsion of the eye in this second position is the same as if the eye had ar-

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rived at this position by turning about a fixed axis perpendicular to the initial and final positions of the line of fixation."[4] The term "torsion," as used by Listing needs clarification: It does not indicate any actual rotation around the anteroposterior axis but rather a position of the globe. Peter[5] suggested "false torsion," a name that does not help to clarify the situation.

True torsions, that is rotations around the anteroposterior axis, are, of course, of extreme interest in connection with the problem under discussion. It is obvious that if such a rotation should take place, and the eye happens to be corrected for astigmatism, the axis of the astigmatism that coincides with that of the cylinder in the primary position will assume an angle after it has performed a wheel movement. Theoretically two types of movement are possible: A conjugate form if both globes rotate in the same direction, and a disjunctive form if they rotate in opposite directions. Neither one of these movements can be voluntarily performed from the primary position.

There are three ways to induce torsional movements:[6] The most obvious, static-dynamic procedure—that is, turning of the head—is not suitable for experimental work. Obviously tilting of the head not only causes rolling of the globes around the anteroposterior axes; it also calls for compensation of a vertical imbalance created by this type of movement. Besides, only conjugate torsion can be produced, and the disjunctive rolling that is most important in connection with our present investigation cannot be induced in this manner.

A second method is to create torsion optokinetically. This means was employed by Brecher,[6] who had the subject observe rotating wheels that were provided with alternating white and black sectors in a haploscope. Up to a certain speed, and for most observers, a rotary nystagmus was produced similar to horizontal nystagmus elicited by a drum provided with black and white vertical stripes and rotating around a vertical axis. If the speed of the wheels exceeded a certain maximum, the torsional movement of the eyes became sustained. Depending on the direction of the rotation of the two wheels, the rotary nystagmus—and torsion—was either conjugate or disjunctive.

The method most frequently used to study torsional movements, however, is through actuation by optical means. Most frequently one or the other modification of the haploscope is used.[7-11] Helmholtz[12] described a rather ingenious device to cause rotation of objects. Two right-angle isosceles prisms are held in front of one eye in such a manner that the surfaces of the hypotenuse are parallel but in opposite directions. Since objects viewed with such an arrangement undergo a double inversion (left to right by one prism, and vertical inversion by the other) they appear in an unaltered position. If the two prisms are rotated around their common axis, an apparent rotation can be effected. Helmholtz was able to compensate for a rotation of up to 7 degrees. The most recent, and at the same time the most accurate, investigations have been undertaken by Ogle and Ellerbrook[13] by means of the space eikonometer.

The idea that prompted all these investigations was to determine in the interest of binocular vision whether the eyes would follow any rotation that the objects underwent. If such vision is maintained, this may be due to fusion without any torsional movements of the eye, or the eyes may execute the same amount of torsion as the object viewed. A third possibility is a combination of the two: The torsion of the eyes lags behind the rotation of the objects, and the difference is supplied by fusion.

In the first instance the image points would have to fall on corresponding areas of both retinas. Corresponding retinal areas are a function of two lines: The horizontal line of separation (Ruete) or the horizon of the retina (Helmholtz), and Ruete's vertical line of separation (Helmholtz' apparent vertical meridian). It is only necessary

to state the longitudinal and latitudinal deviation in order to express the exact position of any point on the retina. If the two positions are identical, the retinal points are corresponding; otherwise they are disparate (Fechner). It should be recalled that the vertical lines of separation do not coincide with the geometrical vertical line: The upper ends tilt outward from 0-1° 30′.[14] The only plausible conclusion that can be drawn from this fact is that, in most instances, it is impossible for all points on a vertical line to fall upon corresponding points of the two retinas. Most investigators seem to agree that the eyes actually perform cyclotorsional movements.[7-9, 11-13, 15-16] Verhoeff[17] in his earlier publications doubted that cyclotorsion actually occurred. He argues that if (fig. 1), torsional movement would take place to fuse the two vertical lines in (a) the two horizontal lines in (b) should include an angle. Actually they form a continuous line as in (c).

No torsional movement is necessary for this effect but fusion of the disparate points of the two vertical lines will result in one single line. It should be noted that the declination of the two vertical lines impresses stereoscopically as an inclination; that is, the upper part appears to be closer to the subject. An even stronger argument was introduced by Verhoeff when he pointed out that cyclotorsion could not possibly account for fusion in the case of the two curved lines illustrated in Figure 2.

Again, the resulting single vertical line can only be explained as being the product of

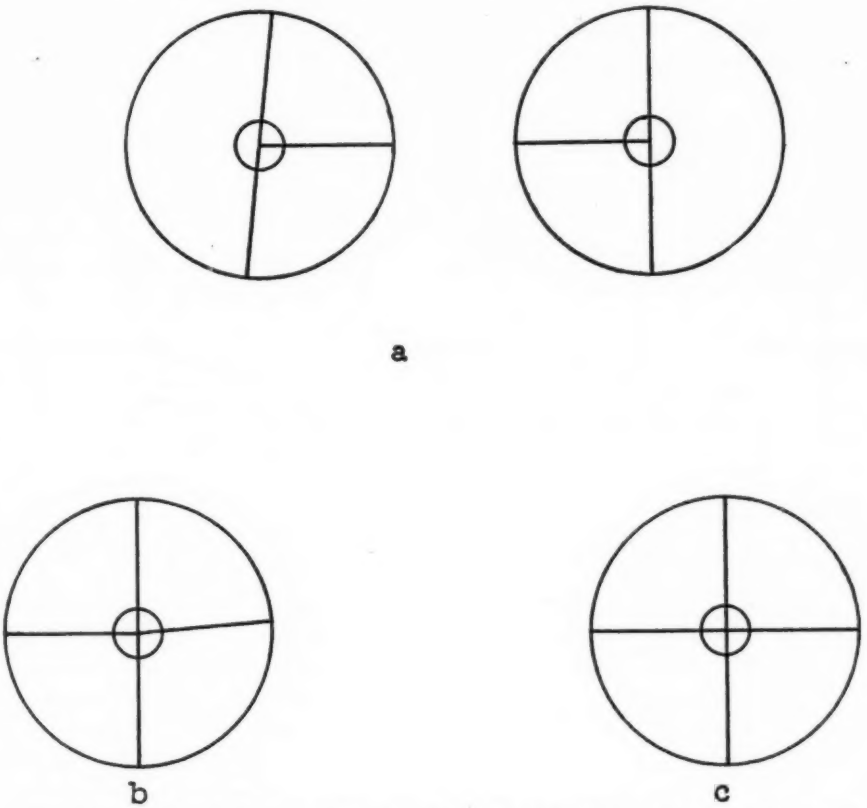

Fig. 1 (Van Wien). Fusion of the two circles in (a) will result in one vertical and one horizontal straight line (c). The vertical line declines forward. This is due to cyclofusion of the two vertical lines and not due to cyclotorsion which would result in an angulation of the horizontal line (b).

fusion of disparate points and, consequently, a stereoscopic illusion prevails.

Years later, Verhoeff[10] repeated Hofmann's and Bielschowsky's[11] experiments. There was a modification in the setup, but he employed printed texts as objects, and, this time, he reached almost complete agreement with their conclusions. He considered cycloduction a normal function of the eyes but took great pain in emphasizing that single or multiple lines accord but a feeble stimulus to cycloduction. Printed words are much more effective, and this was the reason why he could not convince himself in his earlier work of the existence of this phenomenon. His maximum range of eso-cycloduction (printed words serving as a stimulus) was 5 degrees, the maximum range of exo-cycloduction was about 4.5 degrees. This contrasts with 20 degrees mentioned by Hofmann and Bielschowsky. What seems to be most significant, Verhoeff was able to demonstrate that maximal cycloduction is always less than the angular deviation of the stimuli required to produce it. It was already noted by Nagel[7] that wheel motions do not exceed 5 degrees for each eye (a total of 10 degrees for both eyes). Ogle and Ellerbrook again report that the torsional movements of the eyes can, to a varying extent, lag behind the angular deviation of the object. According to Hofmann and Bielschowsky, vertical and torsional compensation is relatively slow as compared to the very rapid abduction and adduction. In other words, if cyclofusional movements lag behind the angular deviation at first, they may be rather complete after a certain time interval. Both eyes participate in the rolling, even if the object is rotated for one eye only (Hering).

To summarize, and in answer to our original question, it can be stated that angular displacement of objects can be compensated for by all three possible means; that is, no cyclotorsion at all, only partial cyclotorsion, or cyclotorsion to the exact extent of the angular displacement of the object. Whereas, in the first two instances fusion of the disparate retinal points will guarantee single vision, in the last instance the retinal images will fall on corresponding points. Fusion of disparate retinal points will give rise to stereoscopic vision. It should be remembered, as Ames[9] has pointed out, that only vertical diameters go into perspective. While the human brain has the capacity to interpret noncorresponding retinal areas along the vertical diameter as fused, if they can be interpreted as a single object in perspective, the fusion of rotated horizontal diameters is based on what he calls "corresponding fusional sectors."

The torsional movements discussed so far are forced and unnatural. They can be produced by special arrangements only. It has been necessary to discuss them in order to understand more clearly those that do actually occur under physiologic conditions:

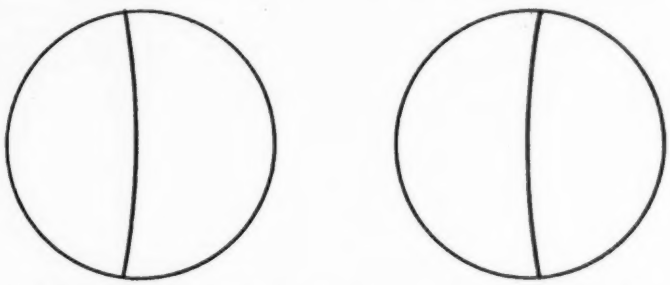

Fig. 2 (Van Wien). Fusion of the two curved lines to produce an image of a single vertical line convex to the observer is entirely possible but cannot be explained by torsional movements of the eyes.

Compensatory movements in instances of cyclophoria and torsions encountered in deviations from the primary position of the globes.

Savage,[18] in his original report in 1890 on what Price later called "cyclophoria," spoke of "insufficiency of the obliques." Although he deserves full credit to recognize this syndrome first, his explanation is based on false premises: A weakness of an oblique muscle would not only result in cyclo- but also hyperphoria.[19] Also, his statistics as to the occurrence of cyclophoria in 25 percent of cases during convergence as an anomaly is open to discussion,[20] and will be dealt with later.

Cylcophoria usually is not included in routine tests for muscle imbalances. This may have two reasons: Firstly, there is no satisfactory treatment for this anomaly; secondly, no treatment is indicated since cyclophoria, usually, does not cause any symptoms. There are two noticeable exceptions to this rule, namely the combination of cyclophoria with high degrees of astigmatism, and "pseudo-cyclophoria" (Savage) that is induced by oblique astigmatism. Peter[21] prefers to call the latter "accommodative" cyclophoria in order to harmonize with terms applied to other subdivisions of heterophoria. This type, accommodative cyclophoria, is considered first.

For an eye suffering from oblique astigmatism or one that has been made astigmatic by a cylindrical lens at an oblique position, the image focused on the retina will lean toward the maximal corneal meridian. In Figure 3a, a cross is formed by a vertical and horizontal line. Let this cross be viewed by a right eye through a strong minus cylinder at axis 135°. Both the vertical and horizontal lines will lean toward the axis of the cylinder, resulting in a displacement illustrated in Figure 3b.

This phenomenon was first described by Maddox.[22] Its explanation seems fairly obvious. In the cited instance the eye has been made hyperopic in the 45-degree meridian (it requires a plus cylinder to correct the minus cylinder at axis 135°). With the 45-degree meridian positive, the 135-degree meridian is relatively negative. Along the 45-degree meridian, therefore, the refractive power of the eye has the effect of a plus lens, and any object point not coincident with this 45 degree meridian is subject to prismatic displacement. The vertical as well as the horizontal line in Figure 3a increase their distance from the effective power of the meridian toward the periphery. According to Prentice's rule, both lines will undergo a continuously increasing displacement away from this 45-degree meridian. The negative principal meridian at 135-degrees, on the other hand, has the opposite effect, that of a prism with the apex along its course, and will displace the vertical and horizontal lines toward it, thus in-

Fig. 3 (Van Wien). A true 90-degree cross as in (a) appears to an astigmatic eye as a skewed cross as in (b); if superposition without fusion could occur, the resultant image would be that of (c).

tensifying the action of the positive principal meridian. In binocular vision, and with the left eye emmetropic, the superimposed retinal pattern will appear as in figure 3c, that is, the two retinal images will not fall upon corresponding retinal points. What is more, they cannot be made to coincide simultaneously by wheel motion. According to Maddox, either intorsion will be necessary

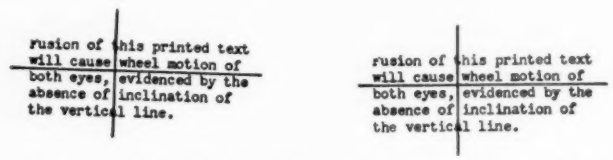

Fig. 4 (Van Wien). This would indicate true wheel motion—the two crosses fall upon corresponding retinal points.

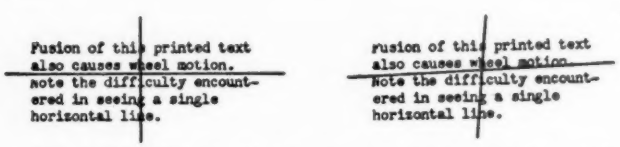

Fig. 5 (Van Wien). If the two squares are rotated toward each other, and the torsion of the two eyes lags somewhat behind that of the targets, the vertical lines will fall on corresponding, or nearly corresponding, retinal areas, and there will be no stereoscopic illusion with regard to these lines.

to bring the vertical lines into the same position, or extorsion to guarantee the same result for the horizontal lines. This explanation has been accepted by the majority of authors.

Only Verhoeff[10] has pointed out that coincidence could be obtained by fusion instead of wheel motion. His reasons have been given earlier in this paper. It is easy enough to determine what happens if Figures 3a and 3b are brought together by fusion: It is impossible to fuse the horizontal lines (unless they are very short, and include a very small angle). The vertical lines can be fused quite easily but the upper end of the fused line will appear tilted forward. This should prove beyond the question of a doubt that this fusion is not brought about by a cyclotorsional movement that would bring corresponding retinal points to coincide. In that case, no stereoscopic illusion would prevail. Only fusion of disparate retinal points will bring about such a result.

It is easily possible to repeat Hofmann's and Bielschowsky's experiments (they also formed the basis for Verhoeff's later investigations) without any special arrangements. With very little practice one can learn to suspend convergence, and fuse identical or nearly identical objects without the aid of a haploscope. Two squares containing the same text are brought into a position where it is possible to fuse them. If these two squares are rotated slowly in opposite directions (either toward or away from each other), single vision can readily be maintained. The motion has to be slow, and only 2 or 3 degrees at a time. If each of the squares is marked with a cross in identical position, there will be only one cross and, after fusion is maintained for a few seconds, no stereoscopic effect will be perceived. This, then, would indicate true wheel motion, that is the two crosses fall upon corresponding retinal points (fig. 4).

The same experiment is now repeated, this time with the two lines forming one cross being declined as it would appear to an astigmatic eye. If the two squares are rotated

toward each other (fig. 5), and the torsion of the two eyes lags somewhat behind that of the targets (as is the case, according to Verhoeff), the vertical lines will fall on corresponding, or nearly corresponding, retinal areas, and there will be no stereoscopic illusion with regard to these lines. The horizontal lines are within Ames's "fusional sectors," and, consequently, will be seen singly but not in perspective. Similarly, in extorsion only the vertical lines need actual fusion. However, in that case, inclination of that line will be noted.

For practical purposes, the "induced" type of cyclophoria does not represent any therapeutic problem at all: Correction of the astigmatic error will eliminate it. The combination of astigmatism and essential cyclophoria introduces a different problem. Routinely, the axis of astigmatism is determined monocularly. However, a wheel motion will take place during the act of binocular vision causing a discrepancy between the axis of the astigmatism and that of the correcting lens. It was this problem that prompted the present investigation. A method to correct this form of "induced" cyclophoria will be suggested later.

In dealing with positions other than the primary, it is necessary to consider conditions prevailing during convergence. Hering,[23] prompted by studies of Meissner, v. Recklinghausen, Volkmann, Helmholtz, and Donders, demonstrated that Listing's law does not apply to positions reached in either symmetrical or asymmetrical convergence. Rather are the vertical meridians declined further outward, or, respectively, less inward in symmetrical positions of convergence than is required according to Listing's law. This deviation increases not only with the increase of the angle of convergence but also with an increase in the depression of the visual plane and in extreme instances reaches almost 5 degrees. In asymmetrical convergence that amount of torsion is very similar to that resulting from equally strong symmetrical convergence. Rarely is there a divergence of the lower ends of the vertical meridians.[24] A striking way to demonstrate this phenomenon is by the following three experiments:

1. With a pencil held vertically but below the level of the eyes, and with this pencil viewed by depression of the eyes without corresponding movement of the head, diplopia can be produced by relaxing convergence. If the two images are then allowed to fuse slowly, it will be noted in most instances that the lower ends touch first, forming a V. Only as fusion is completed will the upper ends touch, resulting in one single pencil in exactly vertical position.

2. If the pencil is held as described, but the depressed vision obtained by head movement, the phenomenon just described is likely to occur but with a decrease in the angle between the two images.

3. If the pencil is, however, held in the vertical plane whether at eye level, or below eye level with depressed vision obtained by head movement, then the declination cannot be observed, and the two images will appear parallel and approach each other in that manner.

This form of cyclotorsion should be considered physiologic (perhaps in the same light as exophoria for near). While undoubtedly cases may exist that are of pathologic origin, as some of those reported by Hughes,[2] it would seem that most of the cases included in Sugar's[3] series are of the physiologic variety. This type of cyclotorsion should hardly ever give cause to visual discomfort because, as mentioned before, it depends not only on the angle of depression of the visual plane but also on the angle that the visual lines form with the plane of the object, and will be minimized if they form a right angle. It is reasonable to assume that the subject, in the process of reading, will instinctively hold the reading material in the most favorable position.

Conjugate torsion of the eyes, as a compensatory movement to the tilting of the head, was denied by Helmholtz,[25] provided

the position of the line of fixation relative to the head remained unchanged. In commenting on this statement by Helmholtz, v. Kries[26] in his notes cites Javal, A. Nagel, Mulder, Skrebitzky, Woinow, Donders, and W. Nagel, all of whom proved the actual existence of such a compensatory mechanism. However, it "amounts to only a small fraction of the inclination of the head. This fraction which is compensated by the opposite rolling of the eye is about one-fifth when the rotations are slight, and gets as low as one-tenth when the rotations are considerable.*"

Depending on the amount of astigmatism, even such a slight discrepancy between the axis of astigmatism and that of the correcting lens must lead to considerable blurring of vision. Glasses, of course, will exactly follow the tilting of the head. For all practical purposes, however, this condition will hardly ever give rise to any discomfort because, under ordinary conditions, the head is not inclined but held in an erect position.

From the discussion thus far it should have become evident that the only instance where a shift of the axis of astigmatism is of importance is when it occurs in connection with essential cyclophoria. These cases are met with not too frequently; nevertheless, ever so often, a patient with strong cylinders will obtain excellent vision monocularly but complain of blurring or tilting of objects after he receives the new correction. It is this type of case that should benefit from an examination under binocular conditions.

Method

A sheet of polaroid filter is used to cover half of the smallest line that can be read with ease on the visual-acuity chart. Another polaroid film is mounted between two thin glass plates in the frame of a trial lens. It is easy to determine that position of the trial lens that blacks out the portion of the visual acuity chart that is covered. The vertical or horizontal axis of that position is marked on the trial lens. It can be inserted in the trial frame with the patient's correction. To insure proper alignment it is preferable to use a phorometer or phoropter. With the polaroid lens in front of the eye not under investigation, binocular vision is guaranteed. At the same time, this eye cannot see the small area that the eye to be examined observes. Copeland[27] has suggested to use a strong plus lens to obtain the same result. However, with Copeland's method, if the lens blurs the vision sufficiently, there is no stimulus for binocular vision and, therefore, the method outlined here may prove superior. The eye not examined, and with the polaroid lens in place, is screened by an opaque cover, and the axis of astigmatism determined carefully with the cross cylinder. Next, the screen is removed and the axis determined again, this time under binocular conditions. Any shift in the axis of astigmatism thus will become evident. This procedure is repeated for the other eye.

Since a combination of cyclophoria and high astigmatism causing clinical symptoms is not too frequent, a series of patients that showed astigmatism of 1.5 diopters or more was chosen at random. In addition to determination of the axis of astigmatism under binocular conditions, a test for cyclophoria for distance only was performed with two Maddox rods in vertical position. The two horizontal streaks of light were separated by 8 prism diopters of vertical prism evenly distributed between the two eyes.

Results

A total of 46 patients were examined. It was felt that, if the cylinders were below a certain strength, slight changes of the axis would be too insignificant to be appreciated; 1.5 diopters was, therefore, chosen as the smallest cylinder. Most cases were considerably higher, the average being 3.61D. Twelve

* It is a daily experience of every refractionist that patients try to correct a wrong axis by tilting the head. Only a compensatory rolling of the eyes can succeed in altering the relation between the axis of astigmatism and that of the cylinder.

patients had astigmatism of 1.5D. or more in one eye only. In these cases, only the eye with the high cylinder was examined. The other eye was neglected, and was not included in determining the average strength of astigmatism.

In 39 cases no variation in the axis of either eye was shown; neither was there evidence of cyclophoria. Among three cases, cyclophoria of 2, 2.5, and 4 degrees could be demonstrated. In these, the axes remained unchanged during binocular examination. Two cases showed a shift in the axis of one eye of 5 degrees and 15 degrees respectively. The strength of astigmatism in the first instance was 1.5D. in the second 2.0D. In one case, the right cylinder of 3.75D. shifted from 15 degrees monocularly to 8 degrees binocularly. The left cylinder of 3.0D. changed from 165 to 170 degrees. This was a disjunctive rolling as could be expected in compensation for cyclophoria. No such anomaly could be demonstrated. Only one patient had a cyclophoria of 2.5 degrees in the left eye (there definitely was no tilting of the right eye when tested with the Maddox rod), and a shift of 5 degrees of the left axis during binocular test. The strength of astigmatism of that case was 4.0D.*

Summary and Conclusions

In evaluating the importance of torsional movements of the eyes it is necessary to examine first those that are forced by experimental methods. They can be produced optokinetically, or by optical means—that is, by prisms—a method suggested by Helmholtz, by various modifications of the haploscope, or by the space eikonometer. It can be stated at present that rolling movements of the eyes do result under such arrangements. However, the amount of rolling does not necessarily have to equal that of the targets employed, and, at its maximum, does not exceed 5 to 10 degrees. If no strong stimulus for fusion is present—that is, a printed text—cyclofusion may take the place of cyclomotion. Unless the torsion of the globes equals that of the targets, a stereoscopic effect in the form of inclination will be observed.

From the clinical point of view this type of wheel motion is of no importance as it does not occur under physiologic conditions. However, a number of problems are met with by the refractionist in his daily routine that should be clearly understood. All these problems have in common the correction of astigmatism since, obviously, a cylindrical correction cannot follow torsional movements of the eyes. Fortunately, the one anomaly that has to be dealt with most frequently, namely cyclophoria induced by astigmatism "off axis," does not present any problem at all: The correction of the astigmatic error simultaneously eliminates the necessity for overcoming the induced cyclophoria. If uncorrected, this anomaly is all the more annoying because the vertical and horizontal axes are not displaced in the same direction but toward each other thus making virtually impossible compensation by actual torsion; this is responsible for the headaches caused by the continuous effort of cyclofusion.

Torsional movements of the eyes with an accompanying shifting of the axes of astigmatism have been observed to occur as a result of changing fixation of distant objects to those at reading distance. This fact is not so much due to convergence as to the depression of the visual axes that occurs simultaneously. If the line of fixation and the plane of the reading matter form a right angle, the amount of torsion is minimized or eliminated. This optimum position will be—more or less unconsciously—assumed during the process of reading. For wearers of a bifocal correction, the plane of the glasses does not form a right angle with the line of fixation. In the case of a high cylindrical correction, a certain amount of "accommodative" cyclophoria is introduced. This accounts for

* A change in the axis of astigmatism amounting to less than 5 degrees was neglected because it was considered to be within limits of error.

the large number of individuals with astigmatic eyes that are unable to wear bifocal glasses comfortably for near work and have to be provided with two pairs of glasses.

The number of patients with actual cyclophoria is small. They are the ones that need special consideration if at the same time they need astigmatic correction. Routine refraction is performed monocularly and, during the act of fusion, discrepancy between the axis of astigmatism and that of the correcting lens results. Most ophthalmologists perform tests for muscle balance routinely with every refraction. It is suggested to include a test for cyclophoria in all cases of high astigmatism. Should there be such an anomaly present, the determination of the axes of astigmatism binocularly can be performed without elaborate equipment by means of polaroid filters and in minimum time. This small extra effort on the part of the refractionist may cut down materially the number of patients that complain of tilting or distortion after they get their glasses.

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TREATMENT OF DELAYED POSTOPERATIVE FORMATION OF THE ANTERIOR CHAMBER*

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Delayed formation of the anterior chamber following cataract surgery is by no means a rare complication. There is, however, a surprising lack of information regarding it in the medical literature. This article was prepared in an attempt to organize some of the available information on the subject and to present methods of treatment of the condition, one of which is original with the author. This original procedure has only been used in two cases, but was so effective that it is reported in the hope that it will be tried by others so that final evaluation can be made.

SURVEY OF LITERATURE

Textbooks on eye surgery are of little assistance in the care of the patient with delayed formation of the anterior chamber. Berens[1] and Wiener and Alvis[2] do not mention the condition. Stallard[3] mentions it but does not discuss its treatment. Spaeth[4] states that delayed closure of the wound and nonformation of the anterior chamber are rather commonly seen, but he gives the impression that it is a complication of rather minor importance and provides no statistics as to its incidence.

Bracken[5] found, in a series of intracapsular extractions using corneoscleral sutures, that only 0.28 percent showed shallowness or absence of the anterior chamber at the first dressing the morning after operation. This figure may be a bit misleading because the patient may have a reformed anterior chamber at the first dressing and lose it later.

McCool and Dickey,[6] in reporting the results of 100 cases of intracapsular cataract extractions, reported four cases (4 percent) having delayed wound union of over one week's duration.

Kronfeld and Grossman[7] made a study of 120 unselected cataract extractions and found that in 20 instances (16.7 percent) there was a delay of more than three days in the formation of the anterior chamber and in 11 instances (9.2 percent) there was a delay of more than five days.

Castroviejo[8] stated that in a series of 150 cataract operations, using corneoscleral sutures, only two cases of late restoration of the anterior chamber occurred. Townes[9] in his review of 500 cases of cataract extraction, reports one case of delayed wound healing of eight days' duration, but states his records are incomplete in so far as delayed formation of the anterior chamber is concerned.

Due to a peculiar series of circumstances, which will be detailed below, there were five cases of delayed formation of the anterior chamber in a series of 60 cataract operations (8.33 percent) performed between January and June, 1947.

SEQUELAE OF DELAYED FORMATION

Management of the condition is important because of the unfavorable effects of the absence of the anterior chamber with its threat to future vision. The most important complications are iritis, iridocyclitis, secondary glaucoma, epithelial cyst of the anterior chamber, and choroidal detachment. Infection entering through the opening in the wound may also occur.

In discussing Heath's[10] paper, Dunnington[11] states that the usual course of events when the anterior chamber fails to reform is:

1. Hypotony
2. Detachment of choroid and retina
3. Corneal opacification
4. Secondary glaucoma

* Presented before the III Pan-American Congress of Ophthalmology, Havana, Cuba, January 6, 1948.

Iridocyclitis

No figures are available on the incidence of iridocyclitis due to delayed formation of the anterior chamber alone. The relationship of iridocyclitis to postoperative glaucoma and of delayed formation of the anterior chamber to postoperative glaucoma make the following figures of interest.

In Townes's[9] series of 500 cataract operations there was an incidence of iridocyclitis of 5 percent following intracapsular cataract extraction and 10.7 percent following extracapsular extraction.

Hughes and Owens[12] in an analysis of 2,086 cataract operations found a similar decrease in iridocyclitis with the intracapsular operation and stated that iridocyclitis is the main factor in the production of secondary glaucoma. Klein[13] in his analysis of 650 operations showed a similar relationship between extracapsular extraction, iridocyclitis, and secondary glaucoma. The incidence of secondary glaucoma following intracapsular extraction in his series was 0.45 percent and following extracapsular extraction, 2.5 percent.

These authors all stress the relationship between iridocyclitis and postoperative glaucoma. However, Kronfeld and Grossman[7] studied a series in which iridocyclitis was not the cause of the glaucoma. In these selected cases the inflammatory postoperative reaction was slight and had either completely subsided or was definitely diminishing in intensity within 14 days after operation. They have shown that the glaucoma which developed was due to the formation of peripheral anterior synechias and that the extent of these synechias was proportional to the length of time the anterior chamber had been flat. Delay in formation of the anterior chamber of over five days resulted in more extensive and denser synechias than those in which the chamber was flat less than five days. If less than five days, the eye was usually able to compensate for the less extensive synechias and maintain normal tension.

Kronfeld and Haas,[14] in a further study confirmed the previous findings that glaucoma was due to the formation of the peripheral synechias caused by contact between the iris and cornea during the period in which the anterior chamber was flat.

Post[15] reported 20 cases of glaucoma following cataract extraction in which 11 cases (55 percent) had shown delayed formation of the anterior chamber for longer than three days.

On the basis of these studies it would appear that anterior chambers which are flat longer than five days are particularly liable to be followed by persistent secondary glaucoma.

Epithelial cyst

Epithelial cyst of the anterior chamber is a serious condition usually leading to loss of the eye regardless of radiation or other therapy used.

Theobald[16] has shown that epithelial downgrowth occurs through poorly healed wounds. In 9 of 14 eyes enucleated for this reason, there was a poorly healed wound. In 5 of these cases the epithelium could be readily traced into the anterior chamber. She reported that 9 of the enucleations resulted from a series of 8,062 cataracts, an incidence of 0.11 percent. There were several eyes in this same series with epithelial cyst of the anterior chamber which were treated by radiation and not enucleated. These were not included in her statistical study.

Townes[9] reports one case of epithelial cyst of the anterior chamber in 500 operations (0.2 percent). Inasmuch as epithelial cyst of the anterior chamber follows poorly healed wounds, delayed formation of the anterior chamber obviously favors its development.

Choroidal detachment

Choroidal detachment is frequently associated with delayed formation of the anterior chamber and was very severe in one of the cases here reported. Spaeth[4] mentions this troublesome complication. As stated by

Heath[10] and Dunnington,[11] it is probable that it is a result of the hypotony produced by the leaking wound, rather than the cause of the flat anterior chamber as has been stated in some of the older literature.

No figures could be found showing the incidence of infection due to delayed formation, but the increased danger with an opening leading into the anterior chamber is obvious.

Causes of delayed formation

Causes of delayed formation of the anterior chamber may be considered under two headings:

1. Decreased production of aqueous by the ciliary body. This was not a factor in any of the cases in this small series. It is believed that, even though an opening cannot be demonstrated in the classical test, practically all cases of delayed formation of the anterior chamber have a leaking wound.

2. Delay in healing of the corneal wound. This may be due to:
   a. Inaccurate apposition of the wound edges when the wound is closed. (Improperly placed sutures may be a factor.)
   b. Interposition of tissue between the margins of the wound—iris tissue, vitreous, lens capsule, and so forth.
   c. External pressure on the eyeball forcing aqueous out through the partially healed wound. This may be due to eyelid spasm, digital pressure, dressings which press on the eye, and straining or coughing.
   d. Decreased tendency of the cornea to heal due to nutritional disturbances.

Causes of delayed formation in this series

1. External pressure:
   a. One case due to premature removal of a corneoscleral suture resulting in slight opening of the wound.
   b. One case due to digital expression of aqueous from the anterior chamber by the patient rubbing his eye with fingers introduced under his dressing.
   c. One case due to a paroxysm of coughing in a case of chronic bronchitis when prophylactic codeine administration was inadvertently omitted.
2. Decreased tendency of the cornea to heal:
   a. One case of impaired corneal nutrition.
3. Undetermined cause:
   a. One case with formation of conjunctival filtering bleb and almost complete choroidal detachment.

Prophylaxis

It has been pointed out that failure of the anterior chamber to reform was due to external causes in three of the above cases. These were premature removal of a corneoscleral suture, rubbing of the eye with a finger, and a paroxysm of coughing. These are preventable causes and obviously every effort must be made to prevent the occurrence of these and similar incidents.

Alvis[17] and Klein[13] have stressed that for rapid and undisturbed healing of the wound, the lips of the incision should be as smooth and close together as possible and that great care should be taken to free the wound of all debris of capsule, iris, cortex, and clots.

In this connection Chandler,[18] Bracken,[5] Hughes and Owens,[12] and Klein[13] have all stressed the reduction in frequency of delayed formation when adequate corneoscleral sutures have been used.

Prevention of this complication is much more effective than its cure and the importance of well-performed operations and good postoperative care of cataract patients should continue to be emphasized.

Symptoms and Diagnoses

All cases in this series complained of some discomfort in the eye and especially of "watering." There was a subjective decrease in visual acuity noticed by the patients if they had had the anterior chamber formed postoperatively and then lost it.

The classical test consists in placing a

drop of fluorescein in the eye with the patient reclining. Very gentle pressure is applied to the cornea with a strabismus hook. If a leak is present, it will be demonstrated by a washing away of the fluorescein solution from the leaking area.

Dunnington[11] states that this procedure will demonstrate a leak in most instances. Chandler,[18] on the other hand, has found that a leaking area cannot be demonstrated in the majority of cases. In this series, the slitlamp, showing the iris against the cornea throughout most of its area, was the best diagnostic aid and the one most useful in formulating the operative procedure to be used.

Technique of the original cataract operation

The original cataract extractions were done by two operators using the same technique. The routine consisted of the usual van Lint akinesia, retrobulbar anesthesia, and subconjunctival blebs of cocaine and adrenalin.

The conjunctiva was incised from the 3- to 9-o'clock positions with a Graefe knife and elevated with Stevens scissors to form a Kuhnt flap. Incisions were made half way through the cornea at the limbus at the 1:30- and 10:30-o'clock positions and two corneoscleral sutures (6-0 black silk) were put in place, looped, and left untied.

The anterior chamber was entered with a Graefe knife and the incision enlarged to include almost the upper one-half of the cornea at the limbus. Iris forceps were inserted and a peripheral iridotomy made with a de Wecker scissors.

In two of the cases the incision was extended through the pupillary sphincter to form a keyhole pupil. In the other three cases the cataract was extracted through a round pupil. The lens was extracted intracapsularly in four cases with the Arruga forceps using a strabismus hook below for counter pressure. In the other case an intentional extracapsular extraction of a traumatic cataract was done.

After removal of the lens, the anterior chamber was irrigated and the iris reposited. Corneoscleral sutures were tied and air was injected into the anterior chamber. The Kuhnt flap was pulled down over the corneal wound and sutured, using two 6-0 black silk sutures.

TABLE 1

LENGTH OF TIME UNTIL THE ANTERIOR CHAMBER WAS LOST: UNTIL SURGICAL CORRECTION: AND UNTIL FORMATION OF THE CHAMBER

Case No.	Original Operation Until Anterior Chamber Was Lost	Anterior Chamber Flat Until Corrected	Anterior Chamber Formed After Surgical Procedure
1	3 days	8 days	next day
2	3 days	9 days	next day
3	6 days	10 days	next day
4	11 days	11 days	next day
5	0 days	12 days	next day
		6 days	next day
		14 days	next day

Eserine and penicillin ointment were instilled and the eyelids splinted with a thin sheet of wet cotton. Eye dressings and a double protective eye mask were applied. The patient was then placed in a crib bed. He was required to remain flat on his back for four hours, after which he was permitted to turn on the unoperated side. He was not permitted out of bed until the eye had been dressed on the second postoperative day.

Careful perusal of the operative techniques did not reveal any demonstrable cause for the delayed formation of the anterior chamber in these cases.

Treatment

No article on treatment of this condition could be found in the literature. In discussing MacMillan's[19] paper, McLean[20] first mentioned using air injection for the treatment of delayed formation of the anterior chamber and it is now being used by a number of other prominent ophthalmologists, including Chandler[18] and Guyton.[21]

Chandler tests the wound for leakage and, if found, cauterizes it with trichloracetic acid or actual cautery. If no leak is found and the chamber has not formed by the seventh postoperative day, air is injected into the anterior chamber.

A small knife is used to make a slanting incision in the lower cornea away from the original cataract incision. It should be 3 to 4 mm. from the point of engagement on the surface of the cornea to the entrance into the anterior chamber over the iris.

A small hypodermic needle on a syringe can be put part way into the tract of the incision but not into the anterior chamber. With the needle in the tract, sharp pressure on the plunger of the syringe will force air into the anterior chamber. The slanting incision acts as a trap door and retains all the air which enters. If the needle is placed all the way into the anterior chamber, much of the bubble will escape alongside the needle.

The air injection restores the anterior chamber and separates the iris from the cornea at the angle. When the air is absorbed, it is usually replaced by aqueous and the chamber remains formed. Inasmuch as all the cases reported in this series had leaking wounds, this method was not used. No statistics on its efficacy could be located.

In those cases in which a leak can be demonstrated in the anterior chamber, Dunnington[11] feels that, as a rule, chemical cauterization is insufficient. He, therefore, places a suture through the leaking area and covers it with a conjunctival flap.

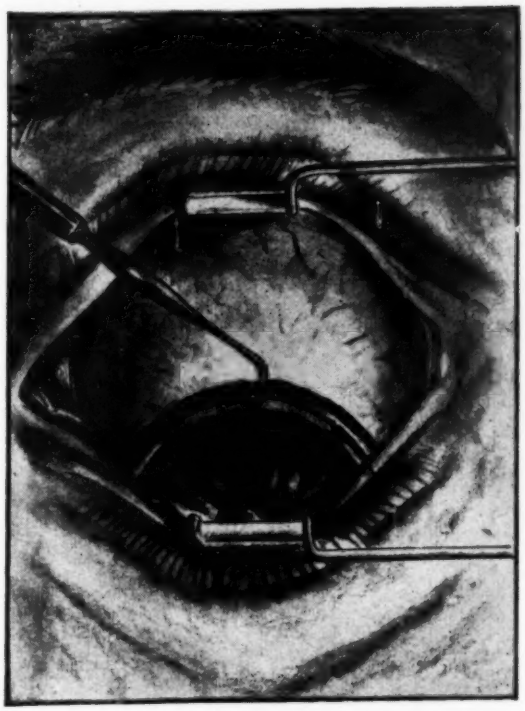

Fig. 1 (Byrnes). In leaking wounds where separation of the surface is minimal, cauterization with a heated strabismus hook will usually produce adequate closure. The conjunctival flap is resutured over the wound.

Surgical procedure followed in this series

This varied somewhat with the case. In all cases the Kuhnt flap was reëlevated. No difficulty was experienced in doing so and in no case was there any resistance or increased friability of the tissues. The wound was exposed throughout its length and in each case inspection alone was all that was required to identify the leaking area.

In three cases the procedure used was to heat a strabismus hook in the flame of an alcohol lamp and lightly cauterize the leaking area of the wound to seal it and stimulate healing. The flap was then replaced in these three cases and sutured in position over the wound. In three cases, the anterior chamber had formed by the following morning and the postoperative course was entirely uneventful.

In Case 4 there was a slightly larger opening in the cornea. The lips of the wound were separated 0.5 mm. for a distance of approximately 1.5 mm. where the corneoscleral suture had been removed at the 10:30-o'clock position on the cornea. It was closed with a single silk suture.

It was felt that a simple cauterization

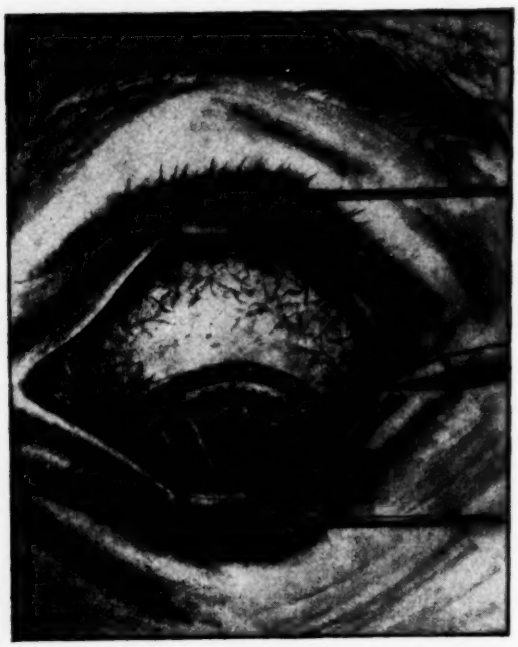

Fig. 2 (Byrnes). When separation of the lips of the wound has been more extensive or there is a decreased tendency of the cornea to heal, very shallow electrodiathermy punctures along the wound margins and extending beyond both extremities are effective.

would be ineffective. For this reason the 0.5-mm. electrodiathermy needle, ordinarily used for retinal detachment operations, was used. With it, tiny, very shallow punctures were made in the cornea and sclera 1 mm. from the wound edges and extending 0.5 mm. beyond either end.

Thrombin was applied to the wound and the cauterized area and to the under surface of the conjunctival flap. The flap was then reapplied to the wound surface and sutured in position. The anterior chamber was formed the next morning and remained so. It had been flat for the previous 11 days.

Case 5 was one in which it is believed the procedure may be credited with saving an eye. This 84-year-old woman had a nutritional disturbance of her cornea and her anterior chamber failed to form after operation. After waiting 12 days, her corneal wound was exposed and an opening found from the 12- to 2-o'clock positions. The corneoscleral suture had cut through the corneal substance which was grayish in color and soft in consistency.

Two corneoscleral sutures were put in place, and the wound was lightly cauterized with a hot strabismus hook. The original suture at the 10:30-o'clock position was still holding. The conjunctival flap was replaced. On the following morning she had an anterior chamber, which she lost by the next day.

She was reoperated at the end of six days. The suture placed at the original operation at the 10:30-o'clock position had cut through, as had one of the sutures placed at the second operation. The wound was resutured with two 6-0 silk sutures and again cauterized and the conjunctival flap pulled down. Again she had an anterior chamber the following morning which she lost in two days.

Ten days later, she had her final operation in which shallow, tiny electrodiathermy punctures were made in the cornea and sclera, thrombin applied, and the conjunctiva pulled down and resutured. Her anterior chamber was formed the next day and has remained so since.

This eye obviously had a decreased tendency to heal and would probably have been lost if it had not been possible to restore wound continuity and improve corneal nutrition. Waiting periods of 12, 6, and 14 days between operations should have been adequate to allow spontaneous healing to occur.

The use of thrombin under the conjunctival flap was prompted by the experience of Tidrick and Warner[22] in the use of hemostatic agents for the attachment of skin grafts. Perhaps the application of thrombin

to the incision area and fibrinogen to the under side of the conjunctival flap would have been effective in the formation of a firm coagulum and it is planned to use this procedure if another occasion arises. The firm fibrin clot so formed should be effective in sealing the anterior chamber.

Postoperative course

The reaction to operation was in all cases slight and, as a rule, the eyes looked better one day postoperatively than they had immediately prior to operation.

The patients stated their eyes felt much better and they were grateful for the decreased "watering." They also noted improved visual acuity which made them feel more optimistic about their future vision.

It is believed that the improved patient comfort and his earlier recovery alone would compensate for the additional surgical procedure, even without the possible improvement in final visual results and the decreased danger of complications.

Recommended procedure

On the basis of the data presented above it is believed that no anterior chamber should be allowed to remain flat more than five days postoperatively. It is considered that the following is the method of choice in treatment.

1. In cases in which no leak can be demonstrated in the anterior chamber, air should be injected through a slanting incision in the lower cornea as mentioned above.

2. In cases with a demonstrable leak in the wound or when air injection has been ineffective:

   a. Elevation of the conjunctival flap.

   b. Use of electrodiathermy to cauterize the edges of the leaking wound lightly, if these edges are in close approximation. In wider wounds or those in which the cornea has shown decreased tendency to heal because of nutritional disturbances, corneoscleral sutures should be inserted, and the application of very shallow punctures, 1 mm. from the wound edge and about 2 mm. apart, extending beyond the ends of the wound opening is indicated.

   c. Application of thrombin and perhaps fibrinogen to the wound area.

   d. Suture of the conjunctival flap over the wound.

   e. Application of the eye dressing.

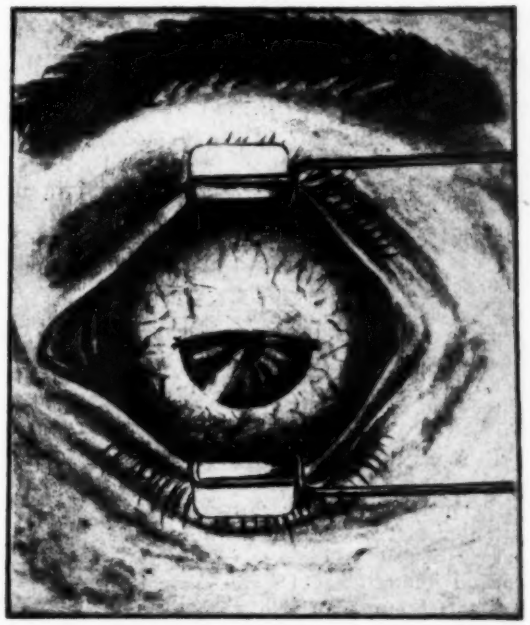

Fig. 3 (Byrnes). The conjunctival flap is resutured over the corneal wound following repair of the leaking area.

Case reports

The following cases are reported in abstract form in an attempt to present only the data which are pertinent to the present discussion. In all cases, laboratory work, unless otherwise mentioned, was negative. Complete eye examinations were done on each patient, but only positive findings are listed.

Case 1.

D. B., a white man aged 63 years.

February 9, 1947. Admitted to the Eye Service from General Surgery for cataract operation O.D. He had a chronic bronchitis with cough which had been improved as much as possible by medical management. He was given codeine (0.032 gm. every 4 hours) to control cough.

February 10, 1947. Combined intracapsular cataract extraction through a round pupil.

February 12, 1947. Eye dressed. Anterior chamber formed.

February 13, 1947. Anterior chamber flat. Patient had a paroxysm of coughing last night when codeine was inadvertently omitted. The patient also admits having inserted a finger under his protective shield to rub his operated eye.

February 17, 1947. Anterior chamber still flat. Choroidal detachment slightly increased. No iris prolapse.

February 21, 1947. Taken to operating room. Kuhnt conjunctival flap reëlevated. There was a small leaking area at the temporal end of the wound. A strabismus hook was heated in the flame of an alcohol lamp and the leaking portion of the wound cauterized lightly. The conjunctival flap was then resutured in position.

February 22, 1947. Anterior chamber reformed. The eye condition good.

March 31, 1947. Eye quiescent. Patient refracted. He has a large central area of chorioretinitis adjacent to the macula. Vision: O.D., 6/12.

This patient's failure to form his anterior chamber was apparently due to a paroxysm of coughing or pressure of his finger under his dressing, or both.

CASE 2.

R. E. S. was a white man aged 82 years.

November 7, 1946. Presented at Eye Clinic complaining of poor vision. Examination showed infiltration of the left cornea with considerable vascularization and slight left exotropia. Some slight corneal infiltration O.D. also. Kahn and Wassermann tests negative. He was given dionin and capsules of riboflavin (3 mg.), ascorbic acid (50 mg.), and nicotinic acid (5 mg.) twice daily.

December 17, 1946. Cornea O.D. now clear. Subjective improvement in vision.

December 31, 1946. Vision 10/200. Eyes quiescent. Lacrimal-sac irrigation and culture negative.

March 3, 1947. Arteriosclerotic vessels and mild central macular degeneration visible. Not well seen because of lens opacity. Admitted to hospital for operation.

March 4, 1947. Operation delayed because of cough and slight fever.

March 21, 1947. Recovered from upper respiratory infection. Intracapsular cataract extraction O.D. through round pupil.

March 23, 1947. Eye dressed, anterior chamber formed; condition good.

March 24, 1947. Choroidal detachment in superior and inferior temporal quadrants. Anterior chamber very shallow.

March 28, 1947. Choroid markedly detached. Tension 3 mm. Hg (Schiøtz); anterior chamber very shallow.

April 1, 1947. Eye still soft with choroid almost completely detached. The conjunctiva appears to be very slightly elevated at the 12-o'clock position; somewhat like the filtering cicatrix seen after a trephining operation. Patient taken to the operating room and the Kuhnt conjunctival flap reëlevated. There was a small leaking area near the 12-o'clock position on the cornea with the lips of the wound in good approximation. There was no prolapse of any kind. The leaking area was cauterized lightly with a heated strabismus hook and the conjunctival flap resutured over the wound.

April 2, 1947. Eye dressed. Anterior chamber formed; condition good.

April 8, 1947. Much improved. Anterior chamber of normal depth. The choroid almost completely reattached.

July 7, 1947. Fundus clear and readily seen. Choroid reattached entirely; eye quiet. Refracted vision 6/12, with macular degeneration present.

This patient apparently had a filtering cicatrix under his conjunctival flap producing the hypotony which he showed. This in turn was probably responsible for the almost daily increase in the extent of his choroidal detachment. The choroid did not reattach until the opening in his anterior chamber was sealed and intraocular pressure was returned to a normal level.

CASE 3

H. V. was a white man, aged 45 years.

March 29, 1947. While hammering on a metal bedstead this patient was struck in the right eye by a fragment. Examination showed a piece of steel (3 by 1.5 by 0.25 mm.) buried deep in the cornea and projecting into the anterior chamber. The lens capsule had been opened by the fragment. The foreign body was removed by electromagnet through the wound of entry. The anterior chamber was irrigated with penicillin solution (1,000 units per cc.), and he was given penicillin parenterally (30,000 units every 3 hours).

April 1, 1947. Eye slightly reddened. No obvious infection; lens has started to swell. No pain. Intraocular pressure 10 to 12 mm. Hg (Schiøtz).

April 4, 1947. Developed pain in the right eye. Tension 35 mm. Hg (Schiøtz). Extracapsular cataract extraction using full cataract incision. This was necessitated by the firm lens material. Incision, sutures, and closure were as described for the other operations.

April 6, 1947. Anterior chamber has reformed.

April 10, 1947. Anterior chamber shallow. Patient states he managed to work his finger under his protective dressing and rub his eye.

April 15, 1947. Iridocyclitis O.D. mild. Keratic precipitates and a 2+ flare present. Iris markings obscured. Started on atropine, salicylates, heat, and foreign-protein therapy. Anterior chamber still flat.

April 18, 1947. Anterior chamber still flat. Operated. The conjunctival flap was reëlevated. There was a leaking area at about the 1-o'clock position. The lips of the wound were cauterized lightly with a heated strabismus hook and the conjunctival flap resutured.

April 19, 1947. Anterior chamber formed. The

eye appears less irritated. Treatment of iridocyclitis continued.

April 21, 1947. Has corneal bedewing, plus-minus flare, no cells, iris markings slightly obscured. He has a pupillary membrane which is chiefly due to the iritis. Discharged to out-patient status to return in three days.

May 6, 1947. Patient finally returned for out-patient observation of his iritis. He has not been using the treatment ordered. Started on iridocyclitis treatment again.

June 17, 1947. The eye is quiescent; not painful or tender; pupillary membrane not touched because of possibility of exacerbation of iridocyclitis. No refraction done.

This patient was one with a traumatic eye with foreign body. His anterior chamber was flat five days before he had a manifest iridocyclitis. Whether earlier repair of his leaking wound would have prevented the onset of the condition is unknown. Certainly the mild surgical interference did not aggravate the iridocyclitis and was apparently beneficial. It was effective in restoring the anterior chamber.

CASE 4

A. P. was a white woman, aged 83 years.

March 18, 1947. Admitted to hospital with severe burns of hands.

April 14, 1947. Transferred to the Eye Service for cataract extraction. Fundus not visualized because of cataract, 2-point discrimination poor.

April 18, 1947. Operation postponed because of fever, cough, and diagnosis of mild pneumonia. Given penicillin by the Medical Service.

April 25, 1947. Cleared by Medical Service for operation. Intracapsular cataract done through a round pupil.

May 5, 1947. Patient, in order to leave the hospital, desired early removal of corneoscleral sutures. One suture carefully removed. Anterior chamber slowly flattened out immediately thereafter.

May 10, 1947. Still has flat anterior chamber. Slitlamp shows only a small central area where cornea and iris are not in apposition.

May 16, 1947. Condition unchanged; taken to the operating room; conjunctival Kuhnt flap reëlevated. There was a leaking area at the 10:30-o'clock position on the cornea where the conjunctival suture had been removed. The wound edges were superficially cauterized, using a 0.5-mm. electrodiathermy needle, and small, very superficial electrodiathermy punctures were placed 1 mm. from the wound margin in cornea and in sclera. These were about 2-mm. apart and extended beyond both ends of the leaking portion of the wound. Thrombin was applied to the wound and cauterized areas and the conjunctival flap was sutured in position over the wound.

May 17, 1947. The anterior chamber has formed.

June 18, 1947. The eye is quiescent. Normal anterior chamber and tension. The media are clear and the fundus readily visualized. There are marked arteriosclerotic degenerative changes present. Vision cannot be corrected to better than 6/120 due to the central lesion.

CASE 5

L. N. was a white woman, aged 84 years.

April 10, 1947. Admitted to the Eye Service because of defective vision. Except for cataracts, her examination was essentially negative. Tension was 19 to 20 mm. Hg (Schiøtz).

April 11, 1947. Combined intracapsular cataract extraction.

April 13, 1947. Eye dressed; anterior chamber shallow, but appears to be formed.

April 16, 1947. Anterior chamber very shallow.

April 23, 1947. There is a mild obscuration of the iris markings and a thin pupillary membrane has formed. Anterior chamber flat. Taken to operating room where the conjunctival flap was reëlevated. There was an opening from the 12- to 2-o'clock position in the cornea where the corneoscleral suture had cut through the corneal substance. The corneal substance was grayish in color, somewhat opaque and soft in consistency. An iris repositor could be readily passed into the wound. Two additional 6-0 silk sutures were put in place and the wound edges lightly cauterized with a heated strabismus hook. The conjunctival flap was replaced.

April 24, 1947. Anterior chamber is formed, but still not as deep as normal.

April 25, 1947. The anterior chamber is flat again. Patient complains of her eye watering.

April 30, 1947. Patient reoperated. Technique used at previous operation was used again. The suture at the 10:30-o'clock position has now cut through the soft corneal substance as has one of the sutures placed at last operation at the 12:30-o'clock position. Resutured with two more 6-0 black silk sutures and again cauterized with a heated strabismus hook and the conjunctival flap replaced. The corneal tissue is still friable and gray in color.

May 1, 1947. Anterior chamber formed. The eye is improved.

May 2, 1947. Anterior chamber shallow.

May 3, 1947. The anterior chamber is flat and patient again complaining of "watering" of her eye.

May 12, 1947. Patient had a cardiac episode; possibly a myocardial infarction. Treatment prescribed by the Medical Service.

May 16, 1947. Patient still has a flat anterior chamber. Taken to operating room and an opening found from the 10- to 12-o'clock position in the cornea. The cornea is still gray, soft, and friable. The same operative procedure, using electrocautery and thrombin, used in Case 4 was used here.

May 17, 1947. The anterior chamber is now formed, but still shallow.

May 22, 1947. Anterior chamber is getting deeper. The eye looks better.

June 3, 1947. Ready for discharge from the hospital. Anterior chamber present. She is not yet ready

for refraction, but her cornea is clearing. After July 1, 1947, she had several attacks of glaucoma with tension, O.D., up to 45 mm. Hg (Schiøtz). This has now recovered.

This case of impaired corneal nutrition is one in which the eye would in all probability have been lost without the surgical procedures employed. If the last operation had been done first, it is quite likely this patient would have had less pupillary exudate formed and might well have escaped the temporary secondary glaucoma which followed the prolonged period of 36 days' duration in which her anterior chamber was flat most of the time.

Summary and Conclusions

1. Absence of the anterior chamber following cataract operation is considered dangerous to the future welfare of an eye because of the possibility of iritis, iridocyclitis, secondary glaucoma, epithelial cyst of the anterior chamber, choroidal detachment, and infection.

2. No anterior chamber should be allowed to remain flat more than five days postoperatively.

3. Surgical procedures have been reviewed which are believed to be effective in the treatment of the condition.

4. An original procedure has been described for use when there is reason to believe there may be a decreased tendency of the wound to heal. It is hoped that others will report their experiences with this method.

School of Aviation Medicine.

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THE USE OF IMMUNE GLOBULIN IN THE TREATMENT OF UVEITIS*

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The treatment of uveitis frequently presents a difficult problem. This disease usually is treated by injection of foreign proteins, by local therapy, and by eradication of any foci of infection. In many cases these procedures do not arrest the condition. A new approach in the treatment of uveitis is the use of the immune globulin.

Immune serum globulin, whether prepared from human plasma or placentas, contains gamma globulin as the active principle. While McKhann and Chu[1] enlarged our concepts concerning the heterogenicity of plasma, researches secondary to the war effort added a great impetus to a more precise understanding of the functions of the various components of human plasma. By electrophoretic means, the heterogeneous nature of plasma could be suspected. The studies of Cohn and his associates[2] made possible the fractionation of plasma, thereby permitting a more accurate study of its various components.

Gamma globulins comprise about 11 percent of the plasma proteins and are found primarily in Fraction II, to a much smaller extent in Fraction III. This component of plasma is thought to have a molecular weight of 156,000 in contrast to 69,000, the weight assigned to serum albumin.

CLINICAL INTEREST

Clinical interest in gamma globulin lies not in its physical constants but in the fact that many of the antibodies elaborated by the defense mechanisms of the body are concentrated in this fraction. Some of these antibodies are those corresponding to the following antigens: typhoid O, typhoid H, influenza A, mumps, diphtheria toxin, and streptococcus toxin. Undoubtedly many others are present which do not lend themselves so easily to identification by biologic methods. In fact, it might appear that the limitations of gamma globulin are determined by the degree of refinement and the multivalence of the plasma pool from which it is derived.

Two epidemic diseases, measles and infectious jaundice, have lent themselves nicely to the exposition of the efficacy of gamma globulin in the treatment and prevention of these diseases. Ordman, Jennings, and Janeway[3] studied the application of this agent to epidemic measles. They showed not only that gamma globulin may be administered without reactions but that it prevented or attenuated the disease in contacts, depending on the size of the inoculum and the duration after exposure when the globulin was administered. Subsequently other reports have justified the confidence in gamma globulin as a therapeutic agent in the treatment and/or prophylaxis of measles.

Stokes and Neefe[4] subsequently applied this principle to the prevention of infectious hepatitis in a children's camp where this disease was prevalent. The figures are more difficult to evaluate because of the greater variability in incubation period, susceptibility, and so forth. With these well-confirmed, practical demonstrations of the usefulness of gamma globulin, it became apparent that clinical exploration in many other diseases might be fruitful. Consequently the present study was undertaken.

TREATMENT OF UVEITIS

The theory upon which I instituted the injections of immune globulin is based upon the fact that the organism requires antibodies to combat infection. In the treatment of uveitis, the function of foreign proteins

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is to stimulate the production of antibodies within the organism itself. It seemed logical to me, therefore, that the patient would obtain greater help in combating the infection if antibodies were supplied directly by injections. For this reason, I used injections of concentrated immune globulin containing both bacterial and virus antibodies.

Results

Encouraging results have been obtained in the treatment of various forms of uveitis by injections of massive doses of immune globulin in conjunction with the use of foreign protein.

Six cases of acute uveitis were treated in this manner, with good results. A detailed report of three of these cases will indicate the method of treatment.

Case reports

Case 1. Mr. W. S., aged 34 years, consulted me first on March 24, 1947. He gave a history of acute inflammation of the right eye of 3 weeks' duration, and of the left eye of 3 days' duration. Diagnosis of acute iridocyclitis of both eyes was made. He had been treated elsewhere with foreign protein, with no result. The patient gave a history of having had an active lung lesion of tuberculous nature in 1935, for which he was treated successfully with a therapeutic pneumothorax in 1941.

This patient was treated by me with triple typhoid injections intramuscularly followed by intramuscular injections of immune globulin for 4 to 5 days. He was then given typhoid vaccine and again treated with immune globulin. This treatment was given for 4 to 5 days; in all, 4 courses of treatment were given.

At his first visit his vision was: R.E., 20/400, L.E., 20/200. By April 29, 1947, his vision had returned to: R.E., 20/25; L.E., 20/30. On reëxamination on August 15, 1947, his vision had returned to 20/20, O.U., and there was no evidence of any ocular lesion.

The severity of this iridocyclitis and its response to this method of therapy leads me to believe that immune globulin played a large role in his successful recovery.

Case 2. Mr. T. H., aged 57 years, was first seen in April, 1945, with an acute iridocyclitis of the right eye. He had recurrent attacks every 3 or 4 months which were treated each time with foreign protein. His last attack in April, 1947, was treated with typhoid vaccine and immune globulin. His vision returned to normal, and 10 months later there had been no further recurrence.

Case 3. Mrs. M. B., aged 51 years, consulted me on August 24, 1947, with a history of a scratch on the left eye with a stick 6 weeks before, which had developed into a corneal ulcer. She was treated at an eye institute for five weeks with sulfa drugs, penicillin, streptomycin, and foreign-protein therapy. A paracentesis was also performed. Examination revealed evidence of old trachoma of both eyes.

The left eye was markedly congested, and there was a dense, white infiltrate situated in the central part of the cornea, involving the stroma. This area did not stain with fluorescein. The cornea was vascularized, and a hypopyon was present in the lower third of the anterior chamber. The iris was bound down. Vision was light perception only.

The patient received 1 cc. of typhoid subcutaneously followed by 3 doses of 5 cc. of immune globulin. On September 19, 1947, the corneal infiltrate desquamated as a sharply defined disc, with healed corneal epithelium underneath. The hypopyon had completely disappeared. At the present time, the eye is completely white. Vision is fingers at two feet, and the patient is comfortable. In all, the patient received a total of 3 courses of injections.

Conclusion

A preliminary report on the use of immune globulin in acute forms of uveitis has been presented. Immune globulin seems to have helped in clearing up a number of

severe cases of uveitis, which did not respond to the usual therapy. Immune globulin should be used in conjunction with foreign proteins and other local therapy. The work is being continued on the use of immune globulin in the treatment of acute and chronic uveitis. Further reports on the results of this work will be made.

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ON NEW TYPES OF OCULAR DISEASES*

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Some of the new types of ocular diseases, which I have had the opportunity to describe, cannot be found in the different handbooks; some of them were described later on by another author, sometimes in numerous publications, and became so known; some were accepted by special textbooks and so saved from oblivion.

1. DIVIDED NEVI

In 1919[1] I described a special type of nevi of the lids, interesting because they are divided by the palpebral fissure. I called them *divided nevi.* Either such a nevus occupies the angle of the lids or one half is on the upper lid and the other on the lower lid. These very rare divided nevi are of a special scientific interest; we know that the lids are closed by epithelium during some time in the fetal life, but it is not yet known if the nevi originate from the epidermis or from the cutis. The divided nevi make it very probable that the place of origin is the epidermis as the connection of the lids is made only by epithelium in the fetal life; it is also likely that the anlage of the nevi is developing just in the time of this connection of the lids.

Since my publication I did not see any other such nevus in Europe and I read only once a paper in which such a case was operated upon and the nevus excised. In China, where nevi are exceedingly frequent and often enormous, I saw only one case

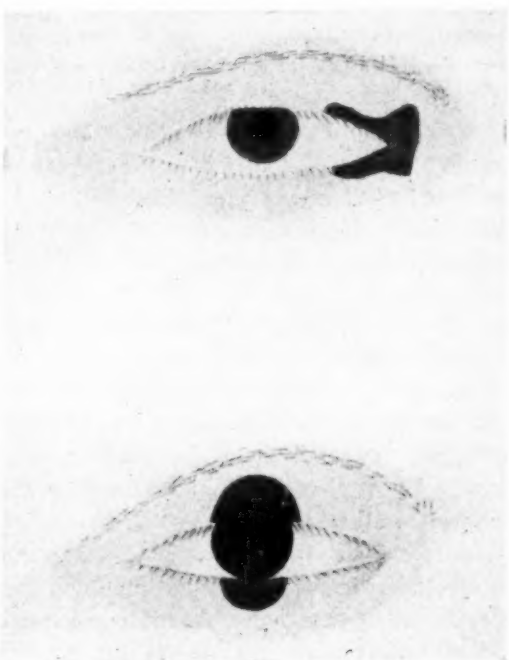

Fig. 1 (Fuchs). Divided nevi. (Above) At the inner angle of the palpebral fissure. (Below) At the middle of the upper and lower lids.

* Presented at the III Pan-American Congress of Ophthalmology, Havana, Cuba, January, 1948.

where the nevus was situated partly on the upper and partly on the lower lid and another case where the inner angle of the palpebral fissure was occupied by the nevus (fig. 1). A third case which I saw in Nanking had been operated upon but soon the lower part of the nevus, which had originally surrounded the inner angle, recurred. This case shows again how dangerous it is to operate on a nevus because, frequently, a number of these cases lead, after an operation, to sarcoma. Arcuri pleads for the removal of every nevus.[2]

2. Sjøgren's syndrome

As a special type of disease, I published the case[3] of a woman, aged 54 years, the secretion of whose tear glands and submaxillary and subligual glands had entirely stopped. She was not able to weep, her eyes had a very disagreeable sandy sensation and she had difficulty in eating anything solid like meat or bread, which she had to wash down with soup or water. The very annoying dryness of the conjunctiva was later on called conjunctivitis sicca by Sjøgren[4] and the syndrome was called later on Sjøgren's syndrome.

A real cause of this condition was not found. It may be that a hormonal disturbance or, as it seems more likely to me, a disturbance of the center of secretion in the mesencephalon is the origin.

3. Behçet's syndrome

The following interesting case was emphasized as a special new disease.[5] A Turkish dentist had frequent attacks of iridocyclitis with hypopyon for years, accompanied by very painful infiltrations in the muscles and fascies and also ulcers in the mouth and on the scrotum. He was examined very carefully but no etiologic factors could be detected. One infiltration of a muscle was excised and the biopsy showed numerous polynuclear leukocytes but no germs or parasites. This man had many posterior synechias and a membrane in each pupil and had become nearly blind. He was treated with salvarsan and showed some improvement.

I tried to get information about this very striking clinical syndrome by asking doctors who had worked as prisoners of World War I in Asia but nobody had observed such a case. Later on Behçet from Istanbul published a few cases of this disease in different medical journals and since then this disease is called Behçet's disease. Just recently such cases were described by different authors.[6] This disease apparently does not occur in China, at least many eye doctors (about 100) whom I asked about it had not observed such a case, the symptoms of which are so conspicuous.

4. Keratitis parenchymatosa linearis

In 1926 I emphasized a new type of interstitial keratitis due to hereditary syphilis and I gave it the name *keratitis parenchymatosa linearis.*[7] A very slight interstitial keratitis starts as a line which detaches itself from the limbus; this slightly undulated line-shaped opacity migrates slowly across the cornea to the other side. This opaque line shows precipitates on the posterior surface of the cornea and gives a very characteristic clinical picture. The syphilitic etiology was shown in all these cases. This type of disease I believe could be used as an argument against the idea that the interstitial keratitis is an allergic disease as it was maintained by some authors.

In recent years I have seen no more of this very rare type of disease, but it is not astonishing since keratitis parenchymatosa became very rare in Vienna.

5. Neuritis syphilitica papulosa

Another new type of syphilitic disease I called *neuritis syphilitica papulosa.*[8] This most grave papillitis (fig. 2) is characterized by a mass of exudate covering the papilla in such a degree as is not found in any other disease except a beginning case of metastatic ophthalmia. This exudate does

not permit observation of the outlines of the papilla and leads sometimes to a focus on the choroid. Besides there are very severe vitreous opacities and numerous hemorrhages of the retina. The disease occurs in the first two years after the syphilitic infection and needs a long time for recovering, usually it takes a year until the vision gets better and sometimes the vision becomes very good; the visual field may show a sector-shaped defect. As a result of the papillitis frequently a comma-shaped strand of connective tissue starts on the papilla and the point leads to an atrophic choroiditic focus (retinitis proliferans).[9]

Report of a case. A man, 33 years of age, acquired syphilis two years ago and was treated by neosalvarsan, but Wassermann tests were never negative. Two months ago

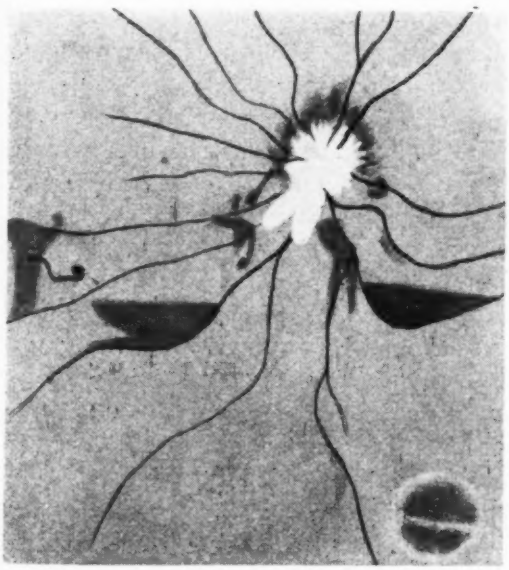

Fig. 2 (Fuchs). Neuritis syphilitica papulosa.

the left eye (fig. 2) showed a very severe impairment of vision and many dust-shaped vitreous opacities. After 1½ years the vision became 6/8. The visual field showed a sector-shaped retraction from above and temporal. The spinal fluid which was highly positive became negative five years after the picture was made.

When I was in Peiping as visiting professor on the P.U.M.C. (1923-24) I saw such a case and used it in my publication. During my stay in China with UNRRA-WHO last year I saw again such a case in

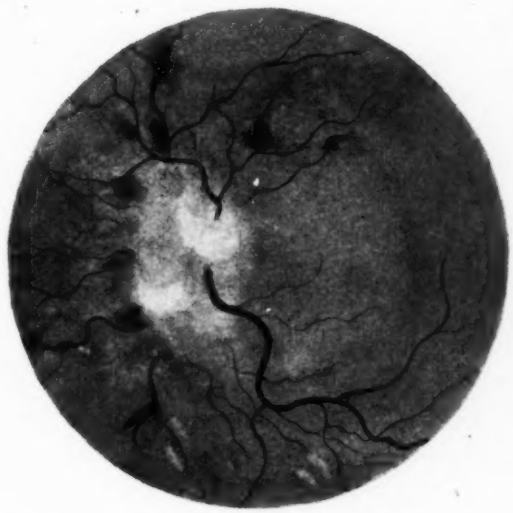

Fig. 3 (Fuchs). *Neuritis syphilitica papulosa.* This drawing is from the collection of Dr. S. K. Chang of Shanghai. The patient, a man, aged 27 years, had had visual disturbances for six weeks. Vision was 0.1. Syphilis had been acquired about 1½ years previously. The Wassermann reaction was a plus three. He was given three salvarsan injections at one-month intervals. After two months, vision was 0.5. The hemorrhages had disappeared.

Chengtu-Szechwan. It was a binocular case which differed from the published cases only by the fact that there were very few vitreous opacities. The young man was seen only once in the E.E.N.T. Hospital and did not return so I was not able to have a picture of his fundus. The vision was very poor and the syphilitic infection had been acquired a few months previously.

I found a typical picture of such a neuritis syphilitica papulosa in the collection of Dr. S. K. Chang in Shanghai which was published as a neurorezidive (fig. 3).[10] Dr. Chang had thought that this papillitis was a Herxheimer reaction and was due to the three salvarsan injections the patient had received some time ago. I do not doubt that

this papillitis has developed independently of it just as all the cases I had seen got the papillitis spontaneously.

These two syphilitic diseases, keratitis parenchymatosa linearis and neuritis syphilitica papulosa were mentioned in the third volume of Duke-Elder's textbook.

6. Myopia inversa

Myopia inversa[11] is not a very rare change of the fundus. One finds a large atrophic zone of the choroid next to the papilla but not on the temporal side as in a common high myopia but on the *nasal* side; that means on the inverse side. This atrophic area can be several disc diameters in size and can also surround the whole papilla, just as in circumpapillary atrophy of the choroid in cases of high myopia, with the exception that the broadest part is lying on the nasal side and the narrowest area on the temporal side. Such a nasal atrophic zone of the choroid can get larger during the years. Sometimes this nasal atrophy is present in both eyes; sometimes it is only in one eye, while in the other eye a temporal atrophic zone is present.

The nasal atrophy differs from the typical congenital white narrow nasal conus; the zones are much bigger and they are quite different in shape; their color is yellowish and not whitish like the nasal conus. A development of such a nasal atrophic zone out from a congenital conus is not likely because I did not see in one of these cases a differentiation of a white congenital scleral nasal conus in the yellowish atrophic zone.

The central vessels in the papilla divide as a rule in an inverse type; the temporal half of the papilla appears as a rule normal and a special supertraction of the temporal border of the papilla is present only in some instances. The fovea centralis sometimes seems to lie nearer to the papilla than normal but also in those cases I found the blindspot on the normal place of the visual field.

The cases of myopia inversa differ from the cases of the common high myopia with temporal atrophic zone in the following point. If there is a temporal atrophic choroidal zone, we are, as a rule, able to estimate the height of the myopia by the breadth of the zone; a broader zone corresponds usually with a higher myopia. This is different in inverse myopia because very often the myopia is much smaller than we would expect, although the nasal atrophic zone is very broad.

The cause of this nasal atrophic zone is without doubt a pulling on the choroid toward the nasal side. We can find sometimes a higher myopia of the nasal part of the fundus than of the posterior pole of the eye or of the temporal side of the fundus. That shows us a special unusual ectasia of the nasal sclera. This ectasia is based on an embryologic anlage that is made clear by the so frequent inverse division of the vessels. But the fact that the nasal fundus shows often a poor pigmentation shows us that we may have here, besides a congenital poor content of pigment in the pigment epithelium, a traction of the choroid, just as we have that often in common high myopia; one can see excellent examples of this condition sometimes in a case of high myopia with staphyloma verum[12] where in front of the dark reflex of the scleral step the fundus is sometimes brownish-red while the area of the staphyloma verum appears albinotic.

To this group of myopia inversa belong also the exceedingly rare cases, where the papilla and its neighborhood are normal in spite of high myopia but where the nasal fundus is markedly poor in pigment and shows considerably higher myopia than the temporal fundus. Such a case, that of a woman, 32 years of age, had a perfect normal papilla; the temporal fundus was reddish-brown and changed suddenly in the vertical meridian to a tesselated nasal fundus.

Her corrected vision was: R.E., −11D., 5/8, on the posterior pole of the eye; but −14D. sph. ⌒ 0.75D. cyl. ax. 25° in adduction; L.E., −6D., 5/8, on the posterior

pole of the eye, but −9D. sph. ⊂ +0.5D. cyl. ax. 180° in adduction.

In China I saw two cases of inverse myopia: the first, that of a man, aged 32 years, had refractive errors of: R.E., −6D. and nearly no conus at all; L.E., the same and an atrophic zone of a 1/2 p.d. breadth on the nasal side.

The second case was a high myopic man, 42 years of age, with a cerebellar tumor. On the right eye a common circumpapillary atrophy of the choroid was present and the disc was indistinct and very little swollen; while on the left eye there was a large nasal atrophy of the choroid and a very marked choked disc (fig. 4).

The second case was especially interesting for the following reasons; I had emphasized in a previous report that, in eyes with circumpapillary atrophy of choroid due to high myopia, frequently other changes of the fundus and the papilla do not develop. So highly myopic eyes often show absolute glaucoma and perfect blindness and a simple atrophy of the optic nerve without glaucomatous excavation. Also retinitis pigmentosa and choked disc can be missed on an eye with high myopia while the fellow eye without high myopia shows the typical picture. Now in this Chinese the choked disc

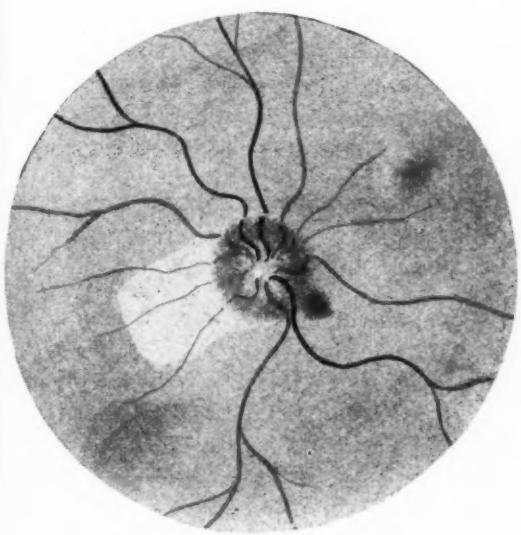

Fig. 4 (Fuchs). *Myopia inversa.* A common circumpapillary atrophy of the choroid was present in the right eye and the disc was indistinct but there was very little swelling. In the left eye, shown here, there was a large nasal atrophy of the choroid and a markedly choked disc.

Fig. 5 (Fuchs). The case showed a big nasal atrophic zone of the choroid and a typus inversus vasorum on the left eye. In the fovea was situated a grayish focus (Fuchs's spot?).

was very much more conspicuous and easier to see on the left eye with the *nasal* atrophic zone than on the right eye with the high myopia and circumpapillary atrophy.

Pathologic changes in addition to myopia inversa I saw in two other cases many years ago in Vienna. The first case, that of a woman, 63 years of age, had a big nasal atrophic zone of the choroid and a typus inversus vasorum on the left eye (fig. 5). Below and on the nasal side, the fundus was albinotic while on the posterior pole and the temporal side the fundus was brownish. In the fovea there was a grayish focus, larger than the papilla. This focus was considered by some doctors as a coloboma of the macula while I thought it might be an old Fuchs spot because the patient had had better vision and had formerly complained of metamorphopsia. Vision was: −4D., 6/60-J5. Wassermann test was negative. We have

here a very large nasal choroidal atrophy although the myopia was not high at all.

The second case, that of an old man, was seen in the clinic of internal diseases and therefore an examination of the vision was

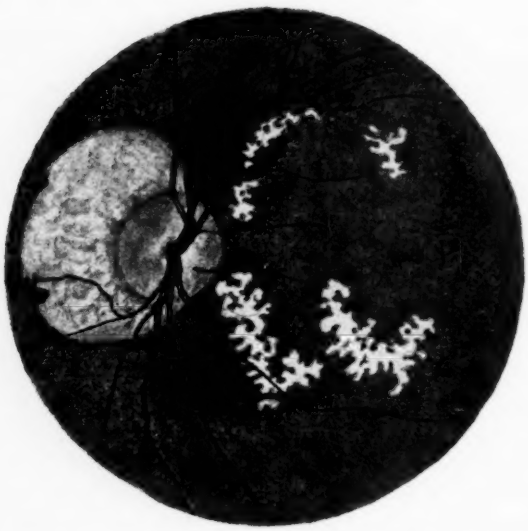

Fig. 6 (Fuchs). *Myopia inversa.* This myopic left eye showed a very broad atrophic zone of the choroid on the nasal side of the papilla and a retinitis circinata around the macula.

not made. The myopic left eye showed a very broad atrophic zone of the choroid on the nasal side of the papilla and a retinitis circinata around the macula (fig. 6).

7. Choroiditis proliferans

A very rare change of the fundus I called *choroiditis proliferans.*[13] It is characterized by a marked formation of connective tissue between retina and choroid. Narrow or broad strands (fig. 7) of whitish color and fine radiation are visible beneath the retinal vessels. Apparently the retina does not produce these strands because the vision is frequently quite good. According to my opinion, this connective tissue is a residue of a retinal detachment especially of an inflammatory detachment due to an exudative choroiditis. I imagine that in the fluid which is poured out between retina and choroid some filaments are formed by fibrin which later on become organized.

This idea was later on corroborated because there are numerous of these cases in China and I saw altogether about six cases of this type. The cause of the formation of the connective tissue in China is mostly Harada's disease which is by no means rare in that country. I saw a number of fresh cases of Harada's disease; some were very severe cases where retinal detachment was combined with deposits, severe iritis with infiltration, shrinkage of the vitreous, perfect blindness, and general symptoms. Some cases are very benign and show only a spontaneous detachment of the retina of short duration without other symptoms of the eye or of a general kind; one case healed in four weeks with final vision of 6/10.

The choroiditis proliferans in China, often monocular, shows the following symptoms: (1) Very long, thin, straight, white strands which are sometimes slightly bent, frequently branched, and sometimes end in a fan-shaped, fine striated connective-tissue layer. Frequently these white strands show knots like bamboo and they can also appear grayish and pigmented. (2) Frequently large areas of the choroid are covered with a thin membrane which hides the texture of the fundus and gives it a strange

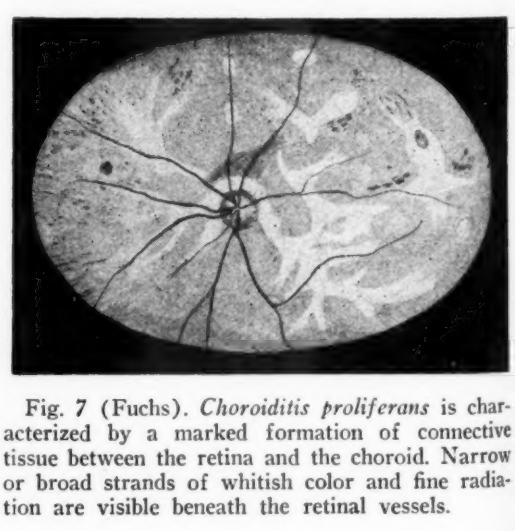

Fig. 7 (Fuchs). *Choroiditis proliferans* is characterized by a marked formation of connective tissue between the retina and the choroid. Narrow or broad strands of whitish color and fine radiation are visible beneath the retinal vessels.

silver-white color, while other parts of the fundus show the tesselated type of membrane (fig. 8).

Sometimes one can find in this whitish area a slight elevation of the retina of 1 or 2 diopters. In such a case the question arises as to whether in such an area the retina is detached or not. The visual field, especially the fact that the patient can see red and blue in this area, shows that there is no detachment and that the neuroepithelium is relatively intact. In spite of an extensive silver-white membrane, the function of the retina is not greatly impaired, and the vision can be relatively good.

8. Neuritis retrobulbaris maligna

In China I found another new type of ocular disease which I could not find described in the available literature. This type I called *neuritis retrobulbaris maligna* and is characterized by a complete loss of vision in a very short time; in 2 to 3 days no light sensation or pupillary reflex on light remains. The fundus and especially the retinal vessels are normal. In Europe we have rare cases of retrobulbar neuritis with perfect loss of vision but an energetic treatment always seems to bring about a certain recovery and not so rarely the vision will become normal again. These Chinese cases differ from the European ones; in spite of energetic treatment the condition cannot be changed and the people remain blind.

The first case I saw was that of a Chinese general who had become blind in two days in both eyes and later on a genuine optic atrophy appeared. It was thought that the cause of this rather sudden blindness was intoxication with alcohol or another poison. The patient was examined in the United States by eminent doctors in a very intensive way but no diagnosis except optic atrophy could be made. I also could not imagine what was the cause, but I saw later a young man, aged 25 years, who became blind quickly in both eyes, and a woman, aged 39 years, who had the same condition in one eye. In these two cases, a genuine atrophy of the optic nerve followed and energetic fever therapy and injections of yatrencasein had not the slightest effect, and the pupillary reflex did not come back.

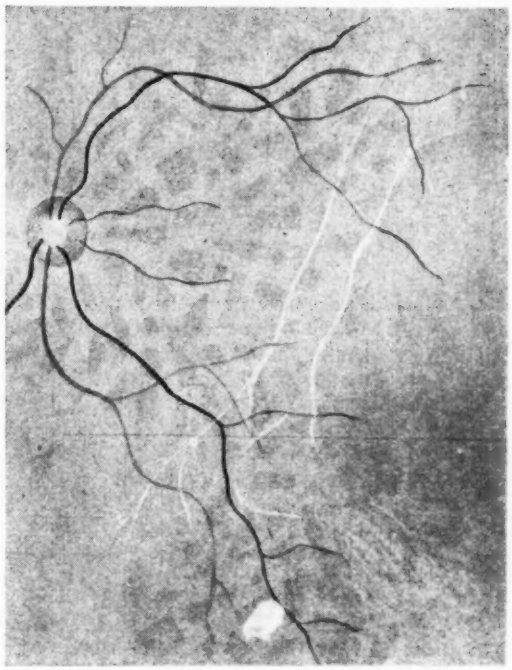

Fig. 8 (Fuchs). Frequently large areas of the choroid are covered with a thin membrane which hides the texture of the fundus and gives it a strange silver-white color, while other parts of the fundus show a tesselated type of membrane.

The important symptom which we generally find in cases of retrobulbar neuritis—slight sensibility of the globe when the eye is touched or moved—was present in all the three cases during the first days of the disease but only in a slight degree. So I learned by these two cases that the general had become blind apparently by the same disease as the two others, namely by a specially malignant retrobulbar neuritis.

This very rapidly developing inflammation of the optic nerve is without doubt combined with a very intense edema, because it seems that the edema compresses the nerve fibers in such a strong way that they are entirely paralyzed and the pressure keeps on for some time so that the

fibers lose their capacity to conduct the nervous impulse and cannot recover. I was not able to detect the etiology.

I have presented here some types of diseases which are either of clinical or of special scientific interest. In China, I was able to observe a few other new types of diseases but I have had no time, as yet, to work up my material.

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College of Medicine.

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Historical Miniature

In the times of the Greeks, Romans, and Arabs, and until the end of the European Middle Ages, all patients who had had successful surgery for cataract had to be content with the very moderate improvement in vision that was possible without cataract glasses. Sixteen-hundred years elapsed between the first description of cataract surgery by Celsus and of cataract glasses by Daça de Valdes, Notary of the Inquisition in Seville, in 1623. The lenses were numbered 11 or 12 for distant vision and 20 for near work. The numbers seem to correspond roughly to our diopters. The worthy notary does not reveal whether this was a new invention or how things were before, and he does not give evidence of the slightest comprehension of the refraction of rays in the aphakic eye.

Hirschberg, *Graefe-Saemisch Handbuch.*

OSTEOMA INVOLVING THE ORBIT*

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An osteoma is a benign tumor of non-inflammatory origin having a circumscribed form, a definite periosteal covering forming a line of cleavage from adjacent structures, and showing active participation of osteoblasts. The tumor commonly originates in a nasal accessory sinus and may invade the orbit relatively early in its growth, causing ocular disability prior to localizing signs in the sinus.

INCIDENCE IN LITERATURE

The many reports indicate that the tumor, while uncommon, is not rare. However, its incidence is difficult to assess as most reports deal with a single case, frequently one presenting bizarre symptoms or complications. The incidence of ocular involvement varies with the site of origin of the osteoma, being almost universal when original growth is in the sphenoid or ethmoid sinus, uncommon with frontal tumors, and extremely rare with those originating in the maxillary sinus. Unilateral exophthalmos arising from orbital tumors was found by Reese[1] to be caused by an osteoma but one time in 174 consecutive cases of surgically verified orbital tumors.

The male is affected more commonly. In Teed's[2] review of frontal sinus osteoma, 172 males were affected to 92 females, a figure corresponding closely to that determined earlier by Eckert-Mobius,[3] who found 110 males to 70 females. The preponderance of males is attributed by Armitage[4] to their greater liability to trauma and the larger size of their sinuses, which are, therefore, the site of greater developmental activity.

Extremes of age of 13 years (Carmody[5]) and 82 years (Blake[6]) have been reported. In Childrey's[7] series of 15 patients, the average age was 46.4 years, but only one case (Case 14) was symptomatic. In Teed's[2] review, the average age was 28.8 years, with 90 percent of the cases symptomatic. The age of the patient when first seen, however, gives little indication as to the time of occurrence because an osteoma may lie quiescent for long periods or reach huge size without symptoms.

The frontal sinus is the most frequent site of development. Malan[8] collected 458 cases; in 178, the growth occurred in the frontal sinus; in 110, in the ethmoid sinus; in 41, in the maxillary; and in 7, in the sphenoid sinus. In the remainder the growth was external, of doubtful origin, or it was questionable as to the first cavity involved.

GROUPS OF OSTEOMAS

True osteomas may be divided into three main groups: the eburnated, which is ivory hard; the compact, which has a structure not unlike that of normal bone; and the spongiose, which represents the most immature type. Externally they present a hard, glistening, rounded surface with numerous facets following the outlines of the sinuses and structures impinged against during the period of growth. They may be sessile with a broad base of spongiose bone, or they may have a pedunculated base of compact bone.

Microscopically, the tumor is covered with well-defined, apparently normal periosteum, with branches extending into the substance of the growth. The eburnated type consists of solid bone without haversian canals and with the bony lamellae arranged in whorl formation. The compact type presents an exterior not unlike the eburnated type, but interiorly, small haversian canals are present, surrounded by concentric rows of

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bony lamellae with irregular arrangements of bony corpuscles in bundles. The spongiose type consists largely of connective tissue with large numbers of fibroblasts and numerous interconnected areas of new-bone formation.

It is most important that the tumor be distinguished from the most common cause of bony hyperplasia of the bones of the skull, namely, the hyperostosis occurring in the course of dural endothelioma. Dandy,[9] who states that he has never seen a localized osteoma, warns that the hyperostosis of meningioma is so common that a degree of skepticism is warranted when a diagnosis of pure osteoma is made. Microscopically, this type of hyperostosis shows the marrow spaces of the bone filled with tumor cells, the invasion of which causes the bony overgrowth.

Theories of cause

Numerous theories have been advanced as to the cause of osteoma, none of which adequately explains its occurrence in each of the nasal sinuses. Arnold[10] believed that the tumor represented ossification of the fetal cartilage at the junction of the ethmoidal and frontal sinus where bone of endochondral and membranous origin were adjacent.

Ersner and Saltzman[11] likened the formation to osteomyelitis where, according to Mosher,[12] osteoblastic and osteoclastic activity take place simultaneously. They considered a low-grade exudative infection in the sinuses might stimulate osteogenesis more than osteoclasis and result in bony tumor formation.

Cushing[13] believed the tumor might be initiated by a fissured fracture of the anterior cranial fossa with a diastasis of the suture between the orbital plate of the frontal bone and the adjacent edge of the ethmoid bones roofing the ethmoidal cells, causing quiescent cartilage to be stimulated to bone production.

Fetissof,[14] who supported his contention with histologic studies, advanced the theory that the tumor initiated from a nest of periosteum split of bone at an early age, which developed a tumor under the influence of irritation and trauma.

Symptoms and signs

Symptoms and signs of osteoma may be conveniently divided into cerebral, nasal, and ocular groups with the predominant type dependent upon the site of origin and with many growths asymptomatic. Cerebral disturbances are uncommon and include mental deficiency, vertigo, various sensorimotor disturbances, convulsions, cerebral pneumatocele, and signs of increased intracranial pressure.

Sphenoidal growths almost universally give rise to intracranial difficulties because of their location, which makes their removal an extremely formidable procedure. Meningitis and brain abscess have occurred following surgery, particularly in cases reported in the preantiseptic days. Cerebrospinal rhinorrhea may complicate surgery of an ethmoidal tumor and is observed rarely preoperatively.

Occlusion of a sinus with resultant infection occurs most commonly in tumors of the frontal sinus because of their predilection for growth at the inferior nasal angle of the sinus. Obstruction of breathing on the side of the tumor is uncommon and occurs most commonly in osteoma of the ethmoid. Anosmia usually indicates cerebral extension with involvement of the olfactory nerve at the christa galli. Fenton[15] reported one case of well-defined nasociliary neuralgia being relieved by removal of a small osteoma of the frontal sinus which was impinging on the anterior ethmoidal nerve.

Ocular signs occur most commonly with ethmoidal and sphenoidal tumors. The ethmoidal type are so likely to extend into the orbit that Cushing[13] labeled them "orbito-ethmoidal" osteomas. Orbital extension usually results in a slowly progressive exophthalmos which, if untreated, may cause loss of the globe.

Fridenberg[16] reported a case in which growth of the tumor from the central portion of the frontal sinus caused an enophthalmos. Rarely, orbital extension from the frontal or ethmoidal sinus causes displacement of the trochlea with signs of superior oblique paresis, a complication which may follow removal of the tumor.

Sphenoidal osteomas tend to involve the optic nerve early, with visual disturbance and optic atrophy, and, rarely, papillitis or papilledema. Occasionally an ethmoidal tumor will cause papillitis, presumably due to involvement of the optic-nerve blood supply.

Diagnosis

The diagnosis is based upon roentgenographic evidence of a well-circumscribed, bony tumor originating in a sinus and the absence of increased thickness of other bones of the skull. Usually there is no question of the diagnosis of the frontal or maxillary-sinus osteoma as the appearance of a localized, isolated bony sphere resting on the floor of the sinus is quite characteristic.

Diagnosis of the sphenoidal tumor can be made with certainty only by microscopic study of the tumor, as dural endothelioma may give rise to a similar picture. This is true, but to a lesser extent, of tumors originating in the ethmoid sinus, although a localized, well-circumscribed bony tumor occurring here without evidence of hyperostosis of the roof of the orbit or sphenoid ridge is most likely an osteoma.

Dandy[17] points out that the age of the patient is an important differential point as dural endotheliomas occur after the age of 30 years and the benign osteoma frequently occurs before. He warns that the burden of proof must rest on the diagnosis of osteoma when made after the age of 30 years.

Treatment

The treatment is surgical but the opportune time and surgical approach have been much debated. Those occurring in the frontal and maxillary sinus frequently remain asymptomatic for long periods and, in the absence of symptoms or rapid growth, surgery is not indicated.

Sphenoidal tumors should be removed immediately, if possible, for the slow but gradual growth will ultimately result in blindness and death. The likelihood of bony tumors in this location being part of the hyperostosis of meningioma is indication enough for the surgery other than their bad prognosis even though histologically benign.

Ethmoidal tumors, because of their early encroachment into the orbit, frequently require early surgery but, in the absence of symptoms or rapid growth and with the patient less than 30 years of age, some procrastination is permissible. Operative intervention will, however, likely be necessary.

The ethmoidal tumors may be removed by an anterior orbital route or by Cushing's osteoplastic transtemporal approach. The anterior route is preferred in cases of well-circumscribed tumors lying far forward in the orbit and in the absence of signs of cranial extension. The transtemporal approach must be used in sphenoidal tumors, those with intracranial extension, and questionable growths possibly secondary to meningiomas. The frontal and maxillary sinus osteomas are probably best removed through an external approach over the involved sinus. Radium and X-ray therapy was successfully used in two cases of spongiose osteoma of the maxillary sinus by Priest and Boies,[18] but was of no value in Case 3 of this series.

Case reports

Case 1

History. The patient, a 24-year-old, white, unmarried farmer, was first seen January 15, 1942. He complained of progressive protrusion of the left eye, of three years' duration. There was no history of trauma and the patient was in good general health except for frequent left frontal headaches relieved with aspirin. He had had the usual childhood dis-

eases and the past history was essentially irrelevant.

Examination. Vision was 20/20 in the right eye and 20/25 in the left eye, improved to 20/20 with a −0.5D. sph. ⊂ +1.5D. cyl. ax. 75° correction. There were 4 prism diopters of exophoria for near and far (Maddox rod) and no hyperphoria. The extraocular movements were normal and the convergence near point, 50 mm. The exophthalmometer (Hertel) reading was: R.E., 18 mm.; L.E., 28 mm. The pupils were equal and reacted normally to light and accommodation. The closed lids did not entirely cover the left eye. At the left inner canthus a hard, fixed, smooth nodule, firmly adherent to the bony orbit, was palpable. Ophthalmoscopic examination showed normal fundi and the peripheral and central fields were normal. Roentgenologic studies showed a dense, bony mass encroaching upon the left orbit, apparently arising from the floor of the left frontal sinus adjacent to the ethmoid plate.

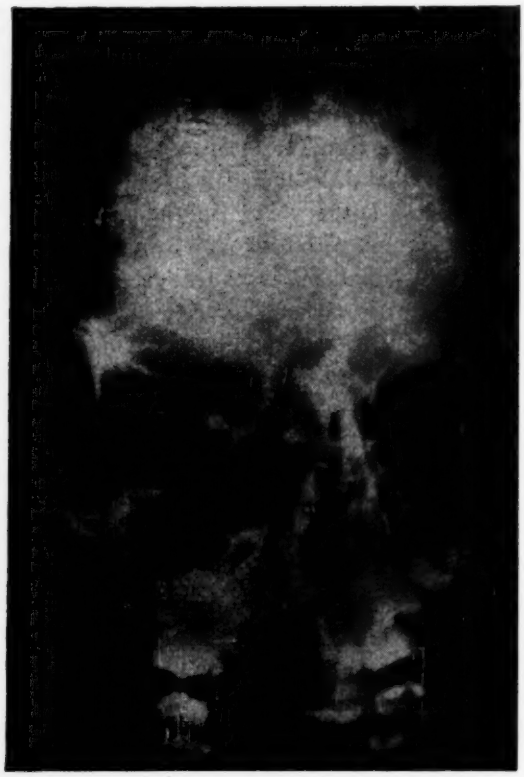

Fig. 1 (Newell). *Case 1.* X-ray study of ethmoidal osteoma involving left orbit.

Operation. On January 16, 1942, under ether anesthesia, an incision was made from the inferior medial angle of the orbit, upward to a point 10 mm. above the insertion of the medial canthal ligament. The ligament was severed, the bony tumor exposed and chiseled free of its insertion in the ethmoid and floor of the frontal sinus. The tumor was then grasped with a rongeur, rocked free, and extracted from the wound.

A large defect in the left frontal sinus was created and a large amount of white, glistening, tenacious mucous removed. There was no evidence of cerebrospinal fluid, and no defect was found in the anterior cranial fossa.

The wound was packed with sulfathiazole powder, the medial canthal ligament was sutured to its original insertion, the wound closed with interrupted black silk sutures, and a compression dressing applied. The first seven days postoperatively, the patient received 4 gm. of sulfadiazine daily. His temperature did not exceed 100°F., the convalescence was uneventful, and the patient was discharged the 12th postoperative day.

The osteoma was a characteristic eburnated type and measured 36 by 32 by 25 mm. It weighed 21.5 gm., and arose from the ethmoidal sinus and invaded the frontal sinus secondarily.

Result. The patient was last seen on March 9, 1942, at which time the eyeball had receded to normal position. There was orthophoria for near and far. Vision was 20/20 in each eye without correction. There was a paresis of the left superior oblique muscle and a diplopia with the red glass on looking down and to the right. The patient was not troubled with this diplopia, and in a recent communication he stated that it is no longer present.

CASE 2

History. The patient, a 22-year-old, white, unmarried farmer, was first seen August 12, 1921, complaining of marked tearing of the right eye the previous four weeks. There had been no improvement of the condition with lacrimal-sac irrigation by his family physician. Past history revealed smallpox in February, 1921, and no history of trauma or nasal infection.

Examination. Vision was 20/20 in each eye, uncorrected. The ocular movements and pupillary reactions were normal. The patient was unable to converge, and there were 12 prism diopters of exophoria for far and near. The lacrimal sacs were irrigated with ease.

One month later the patient noted a small nodule at the inner canthus of the right orbit and X-ray study showed a dense tumor arising from the lateral wall of the ethmoidal labyrinth, invading the orbit and the frontal sinus on that side. In October, 1921, the patient noted divergence and diminution of vision of the right eye.

When the patient was seen on November 18, 1921, there was a right divergent squint of 10 degrees, a palpable tumor at the inner canthus, and a papillitis with elevation of the disc, 2 diopters. Vision was 20/70 and could not be improved. There was no exophthalmos and neurologic examination was negative.

Operation. The tumor was removed by Dr. Frank E. Burch. The postoperative course was uneventful, and the patient was discharged the 11th postoperative day. The osteoma was of the eburnated type with a broad base of cancellous bone attached, apparently, to the lateral wall of the ethmoidal labyrinth. It measured 25 by 29 by 31 mm.

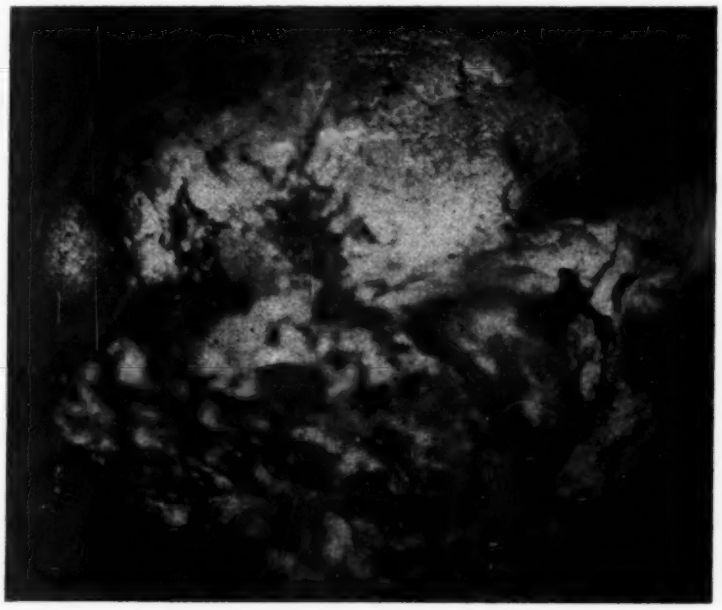

Fig. 2 (Newell). *Case 2.* Appearance of tumor; the rough, irregular surface is the pedicle which was attached to the ethmoidal sinus and the smooth area represents the orbital extension.

Course. When seen in August, 1942, there had been no recurrence. The eyes were parallel and the patient was able to converge slightly. Vision was 20/20 in each eye without correction, and there was an exophoria

of 4 prism diopters for far and near.

Comment. Case 1 presents a typical history and symptom complex, as has been reported in most cases of ethmoidal osteoma. Slowly progressive exophthalmos was the only sign with no signs of involvement of the nose or central nervous system. The almost directly lateral growth of the tumor in Case 2 caused a divergent squint rather than a proptosis.

The exophthalmos in Case 1 and papillitis with diminution of central vision in Case 2 necessitated immediate surgical intervention. In each case the anterior orbital approach yielded a gratifying result; with antibiotics and sulfonamides now available, the danger associated with the exposure of the dura to infection is much minimized.

CASE 3

History. The patient, a 10-year-old, white school-girl, was first seen July 10, 1928,

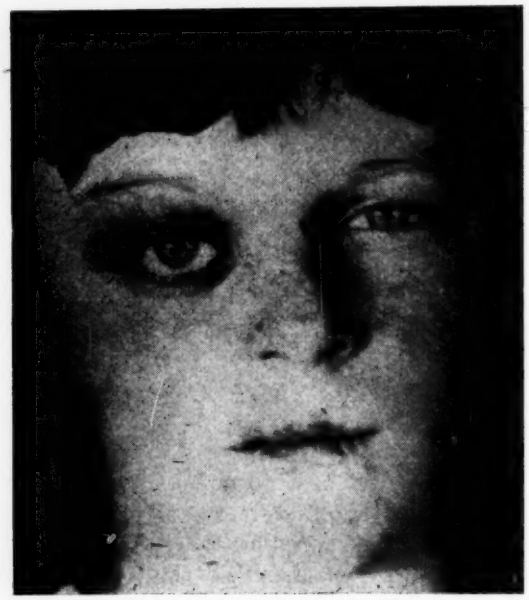

Fig. 3 (Newell). *Case 3.* Appearance of exophthalmos when patient was first seen in July, 1928.

complaining of a proptosis of the right eye, which had first been noted in March, 1926. There was no other complaint, no pain, and the exophthalmos did not appear to be progressive. Past history revealed the usual childhood diseases, including scarlet fever.

Examination. Physical and laboratory examinations were essentially negative. Vision was 20/40 in the right eye and 20/20 in the left, without correction. She was orthophoric for near and far, and extraocular movements were normal. A hard mass was palpable at the external canthus of the right orbit. Exophthalometer (Hertel) reading was: R E., 24 mm.; L.E., 15 mm. Ophthalmoscopic examination was normal.

Roentgenographic studies of the skull showed a dense, round mass which nearly filled the right orbit. The roentgenologist believed that it originated in the inferior, posterior portion of the orbit and stated it had the appearance of an osteoma.

X-ray studies four months later demonstrated an increase in size of the tumor, with likely origin in the sphenoid sinus. When examined on November 20, 1928, vision was 20/70 in the right eye and could not be improved. A definite papillitis was present.

Course. From November 28, 1928, until September 16, 1930, she was followed at the Mayo Clinic and received deep X-ray and radium therapy to the right orbit. She was seen again on May 6, 1931, at which time the right optic nerve showed complete atrophy, the proptosis had progressed, and she had been having convulsions once or twice a week the previous seven months. During the following year the patient again received deep X-ray treatments to the right orbit and radon needles were implanted in the orbit.

The tumor continued to increase in size, and the proptosis became so marked that an exposure keratitis necessitated removal of the eye in June, 1933. During this procedure the anterior portion of the bony mass was removed and studied microscpically. The bone chips had the structure of a compact

osteoma, and there was no evidence of malignant cells in the marrow.

In July, 1933, vision in the remaining eye was reduced to 5/200 and a definite papilledema was present. Convulsive seizures were more frequent and there was mental deterioration. It was assumed that an internal hydrocephalus was present. The patient died at home in October, 1933; unfortunately, an autopsy was not obtained.

Comment. The signs and symptoms of this little girl were characteristic only of an orbital and cranial space-occupying lesion, and diagnosis was dependent largely upon roentgenographic evidence. The age of the patient, slow growth of the mass, and absence of other signs served to differentiate the tumor from a meningioma, as did the study of the anterior face of the growth. The patient was, incidentally, younger than any other previously reported with osteoma. The extensive involvement of the sphenoid bone when the tumor was first discovered made surgery almost impossible, although her tragic end makes operative intervention, however apparently hopeless, seem worthwhile.

CASE 4

History. The patient, a 26-year-old, white, married salesman was first seen on February 12, 1932, complaining of diplopia since February 7th, when he acquired a mild upper respiratory infection.

Examination. He had been examined by an oculist in August, 1931, and a 3-diopter prism base up had been incorporated in his right lens. Vision was 20/70 corrected to 20/20 in each eye. There was 17 prism diopters of left hyperphoria and one prism diopter of exophoria with a vertical diplopia in all directions of gaze. No limitation of extraocular movements could be demonstrated. Peripheral and central visual fields and the fundi were normal. X-ray studies of the sinuses showed an osteoma of the inferior medial angle of the left frontal sinus measuring 5 by 10 mm.

The patient was examined two weeks later, at which time there were 2 prism diopters of left hyperphoria and no diplopia. He has been seen intermittently since that time and, when last examined, on February 24, 1942, he had a left hyperphoria of 11 prism diopters. Corrected vision has remained 20/20 and there has been no change

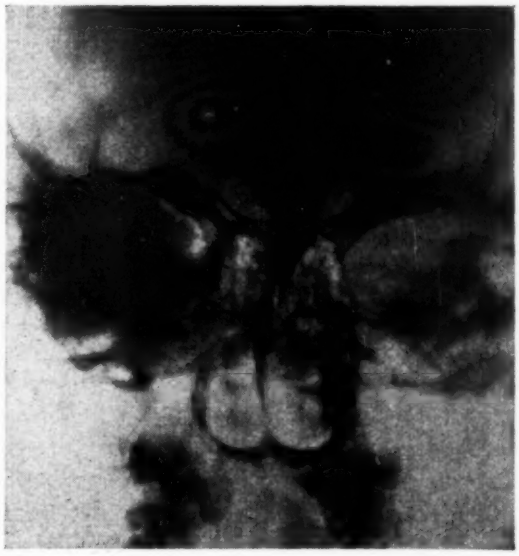

Fig. 4 (Newell). *Case 4.* X-ray study of involvement of the right orbit with a sphenoidal osteoma.

in the fields or fundi. X-ray studies during this period have demonstrated no increase in size of the tumor, and there have been no nasal or cerebral symptoms.

CASE 5

History. The patient, a 20-year-old, white, unmarried woman, was first seen on July 17, 1934, complaining of severe, right frontal headaches following close work.

Examination. Vision was 20/30 and 20/50, right and left, respectively, corrected to 20/20. There were 4 prism diopters of exophoria for far and 8 for near, with no hyperphoria. A slight right ptosis was present. Visual fields were of bizarre conformation and were considered unreliable. Ophthalmoscopic examination showed no abnormalities.

Roentgenographic studies showed the complete absence of the left, frontal sinus and, arising from the inner angle and floor of the right frontal sinus, was a dense, bony mass extending downward along the medial wall of the orbit. Neurologic examination revealed a marked hyperesthesia of the right frontal region, which followed no definite nerve distribution.

Course. When subsequently seen, a marked spasm of accommodation was present, which was not relieved until after daily use of atropine for three weeks. Following this, the headaches disappeared but the hyperesthesia of the forehead persisted. The patient refused surgery and has not been seen since August, 1936, at which time her condition was unchanged.

Case 6

History. The patient, an 18-year-old, white, unmarried, young man, was first seen on August 2, 1934, complaining of severe arthritis involving the shoulders, hips, back, and knees. In routine X-ray examination of the sinuses for possible foci of infection, an osteoma of the lateral portion of the left frontal sinus was demonstrated and ocular examination advised.

Examination showed no abnormality of vision, fields, fundi, or ocular movements. The tumor has not increased in size since the patient was first seen, and he has no complaints referable to the nose, eyes, or nervous system.

Case 7

History. The patient, a 23-year-old, white, unmarried soldier, was first seen on February 14, 1946, complaining of a right convergent strabismus, which had been present since childhood. Previous history revealed no abnormalities, and physical examination was negative.

Examination. A routine sinus X-ray examination prior to ocular surgery revealed an osteoma of the right frontal sinus measuring 2½ by 1 cm. Neurologic examination and complete ocular examination revealed no abnormality other than an alternating convergent strabismus, which was corrected with surgery.

Comment. Case 4 and Case 5 are difficult to analyze because of the bizarre and variable symptoms which cannot be attributed to the osteoma. Case 6 and Case 7 are typical of most frontal sinus osteomas which are discovered on routine examination and seldom, if ever, give rise to symptoms.

Summary

Seven cases of osteomas are presented; in 2 cases the tumors arose in the ethmoidal sinus, in one in the sphenoid body, and in 4 in the frontal sinus. The tumors arising in the ethmoidal sinus were removed successfully, while the sphenoidal osteoma which was considered inoperable resulted in death of the patient from an internal hydrocephalus.

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THE ANTITRACHOMA CAMPAIGN IN JEWISH SCHOOLS OF JERUSALEM

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Jerusalem, Palestine

About 30 years ago, Jewish physicians of Palestine, realizing the danger that, owing to the wide spread of trachoma, threatened both the Jewish population that had already settled in the country and the new immigrants, constituted the first antitrachoma committee. As a result of its activities, trachoma is at present but a minor issue among the many medical problems facing the Jewish authorities.

Trachoma means no longer a danger to the health of the Jewish people of Palestine —a fact that is all the more important in view of the high incidence of trachoma in all countries of the Near and Middle East, in spite of the greatest efforts being made everywhere to tackle the problem.

For example in Egypt an antitrachoma campaign was launched by the government 40 years ago and has ever since been continued with the assistance of other institutions which realized the urgency of the task. However, according to the yearly report issued by the health bureau in Cairo, almost 99 percent of pupils in schools were found affected in 1939. Since that time (according to a personal communication received by the Hadassah Medical Organization from Dr. Wilson, head of the Antitrachoma Service in Egypt, in 1944) no progress has been made and even now practically every single pupil has the disease with the exception of a very small percentage (0.5 to 1.5 percent) belonging to the well-to-do classes.

In Palestine, too, besides the Jewish Antitrachoma Service, several institutions (missions, and others) have assisted the government in its endeavors to meet the danger of trachoma in the country. But, according to a report of the Government Health Office in Jerusalem, in 1939, more than 39 percent of pupils in government schools in Jerusalem were infected at that time, and there is no reason to believe that during the war years, conditions were improved.

In Jewish schools, however, owing to the unrelenting efforts of the physicians engaged in this strenuous work, and the energetic war against trachoma waged by the Hadassah Medical Organization, the systematic and intensive treatment given to every single case has yielded remarkable results. In 1918, at the time when antitrachoma work was started by this organization, the per-

* Physician in charge of antitrachoma, Department of Hadassah. Because the mails to Jerusalem are closed the author has had no opportunity to read proofs of this paper.

centage of active trachoma in Jerusalem among all pupils supervised, was 21.6 percent. This percentage had dropped to 1.8 percent by the winter of 1942-1943, and is now 1.4 percent.*

During the early stages of its activities the antitrachoma committee confined its services to Jerusalem schools, gradually widening its scope and including Jewish schools of other towns, eventually extending to the rural settlements, too.

The aim of this campaign was twofold and consisted, first, of prevention of a further spread of the disease among the population and, second, of the treatment of affected persons. Once or twice a year every single child is examined by an experienced ophthalmologist and, when a high rate of infection is found, the school is immediately placed under supervision, the pupils being from then on examined at monthly or bimonthly intervals. The treatment of infected children lies in the hands of specially trained nurses who visit the schools every day. If corneal complications are detected, the child is immediately presented to the school doctor or sent to the ophthalmologic clinic for treatment.

The routine therapy of trachoma in our schools consists of instillation of a 5-percent copper-sulphate solution (we prefer a solution that has been standing for some time) in combination with zinc-resorcin and frequent expressions for cases of active trachoma; while in inactive cases, a 2-percent copper-sulphate solution is used with zinc resorcin.

In the course of time it was realized that in order to eradicate the disease it is not sufficient to treat a child in whom the infection is accidentally found, for it occurred all too often that a child, after having once been successfully treated, was reinfected at home. Treatment had, therefore, to be extended to the families, too, and, in 1926, clinics were opened by the Hadassah Medical Organization to deal with that part of the population. How successful this procedure was appears from the fact that, for example, in the clinic of the Old City of Jerusalem which opened with 757 cases among a total of 2,237 Jewish inhabitants, the number of infected cases is now no more than 12 among a population that has meanwhile grown to 3,000.

The antitrachoma service is being effectively assisted by the health welfare nurses attached to the schools under supervision by the Hadassah Medical Organization and to the health welfare centers established all over the city. The ophthalmic and welfare nurses do not confine themselves to the treatment of the sick child but also visit the child's family and take care of sanitary conditions in his home.

An important factor greatly contributing to the satisfactory results of the antitrachoma campaign is the systematic care children are now receiving from the day they are born, and during their entire childhood by the health welfare centers. As soon as trachoma is detected there, the child is immediately given the necessary treatment. When he begins to attend kindergarten, he is either completely healthy or at least greatly improved. Thus statistics compiled for kindergarten children in Jerusalem for the years 1942-1943 show a percentage of no more than 1.3 for active trachoma (21 cases among 1,725 children).

The physicians engaged in antitrachoma work know that they are social workers and that their success depends in the same measure on the treatment of the individual case as on the degree to which they are able to reach the population by instruction. Of course, much depends on the social standard and adaptability of the various population groups and it is not surprising that results are not uniform in all communities. The majority of trachoma cases, as regards the Jews, is now concentrated in the oriental communities which, generally, have a lower social, cultural, and hygienic standard. Un-

* These figures refer to schools as a whole comprising all Jewish communities.

fortunately, no data are obtainable on the distribution of the various Oriental-Jewish groups in Jerusalem schools. We are, however, in possession of data concerning the distribution of children aged 5 to 14 years by community in the Jerusalem population at large (census of the Jewish Agency of 1939). In the attached table a calculation has been made—on the basis of these data and the occurrence of trachoma in schools—of trachoma incidence per 1,000 children in each community at the ages mentioned above.

From Table 1 it appears that the highest percentage of cases is found in Persian Jews and the lowest in Ashkenazic Jews. As to the sexes, there is practically no difference. As regards age, the incidence of trachoma in the oriental communities rises up to the age of 10 years, and drops after that age.

TABLE 1

TRACHOMA INCIDENCE PER 1,000 CHILDREN

Community*	Per Mille Trachoma	No. Cases
Persians	50.8	90
Kurdians	48.4	66
Babylonians	48.1	87
Georgians	22.1	8
Bokharians	20.1	11
Syrians	12.2	7
Yemenites	11.1	11
Maroccanians	8.6	6
Sephardic Jews	5.0	14
Ashkenazic Jews	1.0	6

* All these are Jewish communities.

This is in accordance with the view held by the majority of investigators who consider trachoma a disease of childhood, especially where it is endemic.

As a result of the steady drop in trachoma cases, the number of children under treatment for active trachoma was no more than 307 in winter 1942 to 1943; and for inactive trachoma it was 331 of 17,533 children for the corresponding periods. The cases are, moreover, usually mild and pannus or trichiasis have altogether disappeared from among our children.

TABLE 2

DISTRIBUTION OF TRACHOMA IN JEWISH SCHOOLS OF JERUSALEM BY AGE

Age (Years)	Trachoma Cases per 1,000 Children in Jerusalem Schools
4–6	23.0
6–8	28.8
8–10	36.8
10–12	29.4
12–14	9.5
14–16	4.3

From the tabulation in Table 4, it appears that the highest percentage (6.6 percent) is found in the evening classes; that is, among children that may not have had any schooling at all during their younger years. The figures should, therefore, be accepted with certain reservations, since they may also refer to children who have attended schools outside the supervision scheme during their earlier years.

TABLE 3

DECREASE OF ACTIVE TRACHOMA IN JEWISH SCHOOLS OF JERUSALEM FROM 1918 TO 1946

Year (Winter)	Cases of Active Trachoma per 1,000 Pupils Under Supervision
1918/19	21.6
1920/21	21.4
1921/22	18.3
1922/23	13.9
1923/24	13.1
1924/25	11.5
1925/26	9.5
1926/27	14.2
1927/28	13.0
1928/29	11.2
1929/30	11.9
1930/31	9.4
1931/32	8.5
1932/33	7.4
1933/34	3.9
1934/35	3.2
1935/36	2.9
1936/37	2.1
1937/38	4.9
1938/39	4.1
1939/40	3.0
1940/41	1.8
1941/42	1.9
1942/43	1.8
1943/44	2.1
1944/45	1.6
1945/46	1.4

During the past few years it has been tried, therefore, to extend ophthalmic supervision to children of postschool age (evening classes of several youth organizations), and three of Hadassah's ophthalmic nurses have been placed at the disposal of this new service. Moreover, in summer during the school vacations, centers are opened all over the town, where trachoma and acute eye inflammation are treated and to which almost 90 percent of the children come every day.

TABLE 4

DISTRIBUTION OF 307 CASES BY TYPE OF SCHOOL ATTENDED

Type of School	Trachoma Cases per 100 Pupils
Evening classes, etc.	6.6
Talmudei Torah (religious schools)	3.1
Elementary Schools Affiliated with the Education Department of the Jewish National Council	1.2
Elementary Schools Not Affiliated with the Education Department	0.6
Secondary Schools and Teachers' College	—
Kindergartens and Day Nurseries	1.3

Special problems are facing the antitrachoma services in connection with the expected immigration. The arrival of the so-called "Teheran children"* and groups of immigrants from oriental countries (Algiers, the Yemen, and so forth) have taught us a lesson. We must be prepared to wage a renewed war to free this country from the disease, as far as this is possible, and our success depends entirely on the degree to which it will be possible to extend this struggle to the country as a whole and to all parts of the population, Jews and Arabs alike.

Thanks are due to Prof. R. Bachi, head of the Central Bureau of Medical Statistics, and Dr. G. Kallner for their kindness in preparing the statistics.

Gan-Rehavia.

* Jewish refugee children from Europe, usually without parents, who had drifted about for many years before they reached Palestine, their last station being Teheran.

HISTORICAL MINIATURE

Fabricius ab Aquapendente, in 1600, was the first to publish an illustration that correctly shows the position of the lens. Leonardo da Vinci (1452-1519) approached the truth very closely, but his drawings were not published until late in the nineteenth century.

Hirschberg, *Graefe-Saemisch Handbuch.*

FRIEDLÄNDER'S BACILLUS INFECTION FOLLOWING PERFORATING WOUND OF ORBIT*

Report of a case treated with streptomycin

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Friedländer's bacillus infections are unusual. Extensive search of the literature has revealed no previous reports of perforating injury of the orbit, maxillary sinus, and nasopharynx complicated by infection with this bacillus. The case to be reported here developed an orbital cellulitis. Although in reviewing the literature, there were several cases of suppurative sinusitis caused by this bacillus,[1,2] there was only one earlier report of an orbital cellulitis.[3,4]

Dr. Carl Friedländer[5] isolated this bacillus, in 1882, from the lungs of a fatal case of pneumonia and called it Pneumoniecoccus. It was later called Klebsiella friedländeri, Klebsiella pneumoniae, Bacillus mucosus capsulatus, or Bacillus friedländeri.[6]

Recent writers, among them Baehr and his associates[1] and Jaffee,[7] have mentioned this confused terminology and suggest that this organism be called either Klebsiella friedländeri or Bacillus friedländeri. Bergey[6] prefers Klebsiella pneumoniae.

Friedländer's bacillus is a gram-negative, encapsulated rod, varying in size from 0.3 to 0.5 by 5.0 microns, occurring singly and in pairs. It is nonmotile and does not form spores. It usually produces smooth, mucoid, cream-colored, raised colonies on blood agar at from room temperature to 37°C. Hemolysis does not occur but the plate is browned. In broth its growth is turbid, and a ring or film is found at the top of the tube or flask. Numerous fermentation and other differential tests have been suggested and used;[8] however, until Julianelle's classification[8,9] of the Friedländer group into serologically separate types, its recognition was often uncertain.

A recent article by Osterman and Rettger[10] states, "Valid criteria have not yet been established for the differentiation of the organisms of the Friedländer and coli-aerogenes groups." Friedländer's bacilli belonging to Type A of Julianelle's classification may be identified with considerable certainty. Organisms in Type B (which is immunologically similar to, although not identical with, Type II pneumococcus[8]) and Type C (which is identical with the Rhinoscleroma bacillus[11]) may be identified with some certainty. The rest of the group, classified in a heterogenous group X, remains ill defined.

The frequency with which the different serologic types of Friedländer's bacilli are encountered was studied by Julianelle[12] who, working with 80 strains, found 52 percent to be Type A; 15 percent, Type B; 9 percent, Type C; and the remaining 24 percent were considered to be in the heterogenous group X.

It is difficult to discuss the incidence of Friedländer's bacillus infections, since accurate identification was not always made in early cases, nor even in all the later ones. The incidence of these bacilli in the upper respiratory tract of normal persons was reported as 5.8 percent.[13] This figure has been used by numerous authors; however, more recent investigators[1] doubt this percentage of incidence and believe that, on the rare occasions when it is found and accurately identified in the upper respiratory tract, it is present as a contaminant from the intestinal tract where it is reliably found in 5.5 percent of normal persons.[1,14]

The mortality of Friedländer's bacillus in-

* From the Division of Ophthalmology, University of California Medical School. Acknowledgement is made of the technical assistance of Sarah R. Crawford, B.A., and of the valuable advice of Dr. Phillips Thygeson. This work was done with funds from the Mr. and Mrs. Berthold Guggenhime donation.

Fig. 1 (Crawford). Appearance of patient when hospitalized, showing proptosis, whitish exudate, injection, chemosis, and the papilloma.

fections is difficult to estimate. Prior to chemotherapy the prognosis was poor in all cases. In a review of 232 cases of Friedländer's bacillus pneumonia, the mortality was 94 percent.[8] Of the 198 cases of Friedländer's bacillus infections reported by Baehr and his associates,[1] biliary tract infections had a mortality of 30 percent; urinary tract infections, 17 percent; Friedländer's septicemia in the same series, 75 percent. The mortality varies with the type of the organism encountered as well as with the site of the infection. Of the three distinct serologic types, Type A is the most virulent and Type C, the least virulent, for both human beings and mice.[9,10] The pathogenicity of the heterogenous group X is ill defined.[10]

Report of a case

History. The patient, S. P., was first seen at this clinic on February 11, 1947, with a history of having been jabbed two months previously (December 11, 1946) with a pencil which had penetrated the outer portion of his left upper lid. He reported that he had been intoxicated at the time but remembered that there was immediate pain as well as transitory bleeding. The patient stated that the pencil had penetrated to a maximum depth of one-half inch and was certain that it had been withdrawn immediately. He was treated by his local physician for the ensuing "red eye" with one of the sulfa drugs orally, until he was referred to this clinic. Some temporary clearing had been noted approximately the 3rd or 4th day after the injury.

From February 11 until April 3, 1947, when he was admitted to the hospital here, the patient was seen every week or every other week. He was not seen more frequently because he lived a considerable distance away and was short of funds for transportation and board.

Examination. On the patient's initial visit, examination revealed a diffusely injected, thickened, beefy-red conjunctiva; a scanty whitish exudate, a papillomatous mass in the lower fornix, moderate edema of the lids, and slight proptosis of this left eye. Since the patient was positive on repeated questionings by various staff members that the pencil had been withdrawn, laboratory investigation was resorted to.

Smears taken at this time were later reported to contain many neutrophiles, occasional gram-positive cocci, and a few gram-negative rods. The total white blood-cell count was 12,900 and the Kahn and Kolmer tests were negative. The Frei test was doubtfully positive. On initial cultures a few colonies of Streptococci viridans were found as well as numerous colonies of diphtheroids, and a moderate number of colonies of Friedländer's bacilli which gave the characteristic "quellung" reaction with Type-A serum.

Treatment. Sulfathiazole treatment, 1 gm. orally every 3 hours while awake, had been started as the organisms causing the patient's

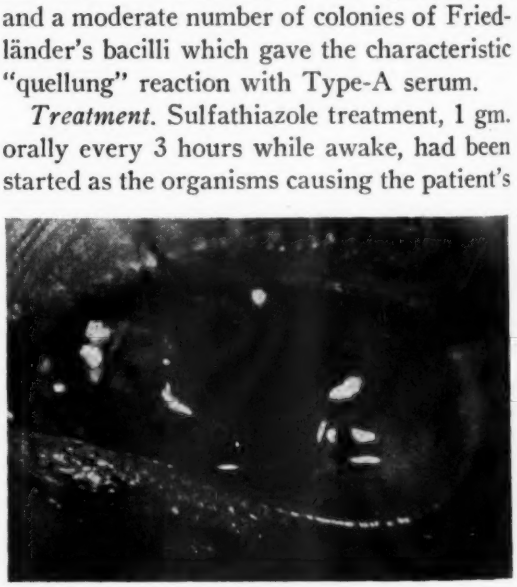

Fig. 2 (Crawford). Closeup of left eye.

posttraumatic infection were unknown at the time.

The papilloma was excised February 14th, and streptomycin ointment was prescribed for local use because of the Friedländer's bacilli; streptomycin was not used systemically as the patient could not be hospitalized. Sulfadiazine was given instead of sulfathiazole since it was believed to be less toxic. Because of the doubtfully positive Frei test, mice brains and chorio-allantoic membranes were inoculated and 300,000 units of penicillin in beeswax were given on two successive days. The egg and mouse-brain inoculations were reported negative for viruses. Orbital X-ray films, taken on February 19th, were reported negative.

Course. When the patient was seen again, the conjunctiva showed some slight clearing but the papilloma had recurred. Otherwise, his condition was unchanged. Smears and cultures were essentially the same.

In the middle of March, stereoscopic views of both orbits, as well as sinus plates, were made. These X-ray studies were negative except for some slight clouding of the frontal and maxillary sinuses. At this time, also, the papilloma was reëxcised. The report of the first biopsy had been: "Nonspecific infectious granulation tissue."

Since cultures had become negative for any organisms other than Friedländer's bacillus—Type A, it was decided to admit the patient to the hospital for systemic treatment with streptomycin, which is reported

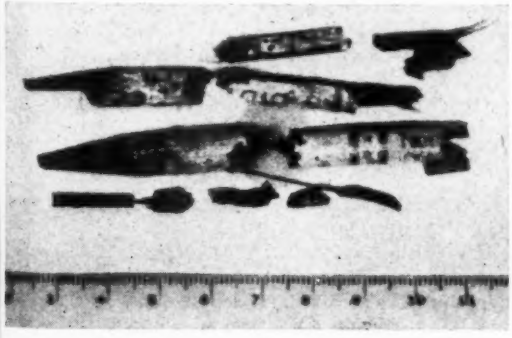

Fig. 3 (Crawford). Pencil fragments removed via the posterior nares.

Fig. 4 (Crawford). Appearance of patient one week after discharge from hospital.

to be the drug of choice in Friedländer's bacillus infections.[15,16]

Hospitalization began on April 3rd, at which time examination of his left eye revealed moderate proptosis (4 mm. more than the right eye). There was considerably more injection and chemosis, and motion was more restricted. The papilloma had again recurred (figs. 1 and 2). Vision was 20/20, right eye; and 20/30, left. The patient's temperature was normal and his total white-cell count, 9,800.

Since laboratory investigation revealed that the infecting Friedländer organism was extremely sensitive to streptomycin, in spite of the local use of streptomycin ointment, the patient was given 1 gm. of streptomycin intramuscularly daily, divided into 4 doses.

Streptomycin therapy for seven days resulted in considerable, but not complete, clearing. Cultures from the conjunctiva were still positive for Friedländer's bacillus, although the number of colonies was reduced. The nasal cultures were also positive. Blood cultures showed no growth. A rhinolith in the left nares, diagnosed at this time, was thought to be the cause of the persistent infection.

Operation to remove the rhinolith was performed on April 12th. This was found to be the pencil which had been driven through the orbit into the left superoposterior portion of the nasal cavity. Approximately 3½ inches (9 cm.) of pencil fragments were removed through the nose (fig. 3).

Postoperatively, the conjunctiva showed some further clearing and the papilloma was nearly absorbed. Conjunctival cultures be-

came negative for the first time; however, posterior nasal cultures still showed the Friedländer's bacillus, although in much fewer numbers than before.

Penicillin, 40,000 units intramuscularly every 3 hours, was given prophylactically after the operation, in addition to the streptomycin.

Reëxamination of the original X-ray plates showed the pencil, and new plates indicated that about one inch of the pencil remained. It had, apparently, been pulled down into the region of the posterior nares. It was decided that further surgery should not be done at this time, and the patient was discharged to be observed in the clinic. Chemotherapy was discontinued. The patient's total white blood count at this time was 8,560.

The patient returned after one week showing some slight persistent conjunctival injection but the papilloma had been absorbed (fig. 4). During examination he blew out through his nose about a one-inch length of pencil lead. Some wood may still be present. Conjunctival cultures showed no growth; however, nasal cultures showed Friedländer's bacillus, Type A, and coagulase positive Staphylococci albus and aureus.

Two months later the patient had failed to return, although a postcard indicated that he was well.

Conclusion

A case of Friedländer's bacillus infection of the orbit and maxillary sinus following a perforating injury has been reported. The patient was improved after removal of the foreign body and treatment with streptomycin, which is considered to be the drug of choice in Friedländer's bacillus infections.

It is realized that infections with this bacillus may wall off and form abscesses which later may erode through or break down. So far no such tendency has been noticed in this patient.

Also, in conclusion, it must be emphasized that, in a patient with a history of injury, especially with a granulomatous lesion, the possibility of a foreign body should be borne in mind.

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ANALYSIS OF OCULAR MOTOR ANOMALIES*

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One of the most difficult subjects confronting the average house doctor in ophthalmology is the study of ocular motor anomalies. Although he may have a good understanding of the basic anatomy and physiology of the extraocular muscles, he is often confused by the complexity of the clinical findings presented by a patient with strabismus. To find his way successfully through this confusing data, the average house doctor needs an organized method of approach. Only by using such a guide can he readily recognize the important factors in the defect and intelligently institute therapeutic measures to correct them.

THE MOTILITY CLINIC

The first step in organizing the study of motor anomalies in a large hospital is the establishment of a special clinic devoted entirely to studying, classifying, and treating the various forms of motor anomalies. The second step is the use of a simple, practical method of analyzing the complex manifestations presented by patients with ocular motor anomalies.

Two years ago a special clinic for the study and treatment of ocular motor anomalies was started at the Wilmer Institute. The personnel of this clinic includes both ophthalmologists and orthoptic technicians. A member of the teaching staff is in continuous charge of the clinic, and three members of the resident staff, two internes, and one assistant resident are assigned to the clinic in rotation.

Every patient with any type of ocular motor anomaly seen in the general eye dispensary is referred to the Motility Clinic, after a complete external and ophthalmoscopic examination and cycloplegic refraction have been made. The Motility Clinic meets weekly. There the patients are studied by the doctors and orthoptic technicians according to a standardized plan of analysis. When the studies are completed, the patient is presented to the entire group, the problems are discussed, a diagnosis is made, and a plan of therapy is outlined.

If orthoptic training is the first step in therapy, the patient is turned over to the technicians who make subsequent appointments on other days of the week. However, every six weeks the orthoptic technician sends the patient back to the Motility Clinic so that his progress can be observed by the entire group. This provides a constant check on the accuracy of diagnosis and permits any changes necessary in the plan of therapy. If operative treatment is the first therapeutic step, the Motility Clinic recommends the type of operation and follows the patients postoperatively. On discharge from the hospital, an appointment is made for a return visit to the Motility Clinic, where the patient is reëxamined and any further therapeutic measures are instituted.

In this way the Motility Clinic acts as a central clearing house for all patients with motor anomalies. The constant interchange of opinion between the ophthalmologists and the orthoptic technicians has resulted in mutual understanding and excellent coöperation.

We have found this method of joint discussion in a Motility Clinic far better than the former plan of referral of patients to a separate orthoptic clinic. Often doctors referring patients to the orthoptic clinic had little idea of the aims, methods, or problems of the orthoptic technicians. On the other hand, the technicians sometimes lost sight of the broader aspects of the strabismus and in

* From the Wilmer Ophthalmological Institute of The Johns Hopkins Hospital and University. Presented at the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 12, 1947.

their intense and persistent efforts to correct some phase of the sensory anomalies, occasionally subjected the patients to unnecessarily prolonged orthoptic treatment. In the Motility Clinic, the members of the house staff become acquainted with the principles and problems of orthoptics and acquire some skill in the use of orthoptic instruments in diagnosis and treatment. By periodic reexamination of the cases by the entire group, it is difficult to overstress any one aspect of the case, and orthoptics is viewed in proper relationship to the other problems of strabismus.

Method of analysis

The tests used in studying motor anomalies should be simple and the method of analyzing the findings should be practical and easily understood. In the Motility Clinic we have found the following plan the most useful one as it enables the house staff and the orthoptic technicians to grasp the significant factors easily. Figure 1 shows the outline of the examination. It occupies a full sheet, which is included in the patient's unit history.

The first topic is a brief history of the patient as related to his motor anomaly. This is followed by a record of his vision, without and with refractive correction. The next topic is the presence or absence of head tilt. The observations on fixation follow. The type of monocular fixation is noted and an evaluation of the angle kappa is made. Under binocular fixation, the fixating eye is determined not only in the primary position for distance and near, but also in the six cardinal directions for near. As pointed out by White[1] and others, these tests are most helpful in selecting the eye upon which to operate. The rotations of the eye are considered next. The extent of the ductions are measured, a screen comitance test is performed, and the relative or absolute near point of convergence noted.

The prism and cover test constitutes the next heading. We have found that this test is extremely useful in giving the house staff and orthoptic technicians a dynamic picture of the motor aspects of the case. However, before the new house doctor is allowed to progress to the prism and cover test he should become adept in performing the tests mentioned above under fixation and rotation. We have found that new members of the staff rapidly acquire skill with the prism and cover test after they have first learned to make careful examinations on fixation and rotation, and have trained themselves always to be conscious of the position of the light reflex on the cornea.

With the prism and cover test, measurements of the angle of squint are made in the primary position for distance and near both with and without glasses. The deviations are also determined for near with the patient fixating in each of the six cardinal directions. The measurement of the angle of deviation in the six cardinal directions has always been an awkward examination to make. Usually there was no way to stabilize the patient's head; an assistant was needed to hold the fixation light, and there was no standardization of the amount of angular rotation of the eyes from the primary position into the six cardinal directions. Because of these difficulties, the house staff and the orthoptic technicians often omitted this part of the examination.

Since the test is so important in analyzing vertical anomalies and in diagnosing incomitance, we constructed a small light to standardize and control fixation in the six cardinal directions.[2] It consists of a base with an upright bar to which is attached a rotating arm. The arm is provided with automatic stops that place it in the six cardinal directions of gaze. Two bulbs in the rotating arm are used for fixation. One bulb, placed at the center of rotation is used for fixation in the primary position at near (33 cm). The other is placed at the end of the rotating arm. When the patient's eyes fixate this peripheral light, their constant angle of rotation from the primary position of gaze is 25 degrees in

each of the six cardinal directions. The instrument is used on a table with an adjustable head and chin rest.

As the patient fixates the central light, the deviation of the eyes in the primary position for near is measured by the prism and cover test. This is followed by similar measurements as the patient fixates the peripheral light successively in each of the six cardinal directions. We have found that this instrument has greatly facilitated the measurement of the deviation by the prism and cover test in the six cardinal directions of gaze.

In performing the prism and cover test it is important to hold the screen a few inches away from the covered eye so that the examiner may look over the screen to observe the movement of the covered eye. The movement of the eye immediately after covering is sometimes easier to follow than the motion of redress on uncovering. It is important, therefore, that the screen should cover the eye only from the object of fixation and not from the observer.

The tests outlined on the chart under the headings of Fixation, Rotation, and Prism and Cover Tests provide most of the information regarding the motor aspects of the case. The remaining portion of the examination is concerned primarily, but not entirely, with the sensory abnormalities. The type of retinal correspondence is determined by the after-image test and the extent of binocular vision is measured with the Worth lights. The major amblyoscope is then used to determine the objective and subjective angle for both distance and near. The type of retinal correspondence is determined; the presence and extent of suppression are defined; the ability to fuse similar pictures is ascertained; and the presence or absence of stereopsis established.

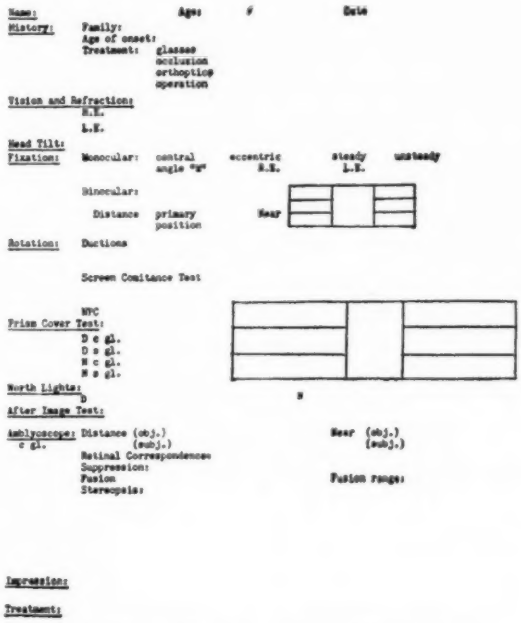

Fig. 1 (Owens). The outline of examination.

We have found that the house staff is generally confused by the classification of fusion into the so-called three grades: simultaneous macular perception, fusion, and stereopsis. They soon find some patients who have the ability to fuse "second grade targets" but lack the ability to superimpose "first grade targets," an ability which is supposed to be a prerequisite for "second grade" fusion.

Burian[3] has pointed out the difficulties in the classification of fusion into three grades. We have found it more satisfactory simply to state the findings in descriptive terms. Any tendency to shift from normal to abnormal correspondence is noted. The presence and severity of suppression are measured by various sized test objects, and the smallest sized target that is not suppressed is recorded. The term fusion is reserved for the ability to integrate similar images produced on corresponding parts of the two retinas into a single mental picture. If fusion is present, the range of convergence and divergence is measured, and finally the presence of stereopsis is determined.

This routine plan of examination is all that is necessary in most of the cases. However, occasionally special tests, such as the head-tilting test described by Bielschowsky, are necessary. The results of these tests can be recorded in the blank space at the bottom of the form.

Evaluation of data

Having obtained this data, the doctor is prepared to evaluate the findings critically and classify the case. Although the same method of analysis is used for all types of motor anomalies, the following discussion will be primarily concerned with cases of convergent strabismus. The horizontal component is considered first. Whether the strabismus is comitant or noncomitant is determined by comparing the squint angle measured in the six cardinal positions of gaze, and coördinating these findings with the results obtained by the tests on ductions and the screen comitance test. This data will separate the paralytic from the nonparalytic squints.

The second point to be considered is whether the strabismus is constant, periodic, or intermittent.

The third factor is to determine whether the squint is alternating or nonalternating. If alternating, the data will tell whether the patient is a true alternator, or whether alternation occurs when fixation is shifted from near to distance vision, or upon shifting the gaze from the left to the right fields of fixation.

From the standpoint of therapy it is important to classify the cases into the accommodative and the nonaccommodative type of strabismus. Patients with the accommodative type have large refractive errors and show a marked decrease in the amount of deviation when the refractive error is corrected. The deviation decreases when fixation is shifted from near to distant objects and often changes from one examination to the next.

Patients with the nonaccommodative type usually have small refractive errors, and exhibit little or no change in the amount of deviation whether the correction is worn or not, or whether fixation is for distant or near objects. In these cases the angle of squint is fairly constant on repeated examinations.

The nonaccommodative type of strabismus is due to two factors. One is mechanical, such as variation in the form of the orbits, the presence of abnormal check ligaments, or faulty insertion of the muscles. The other is excessive innervational tone from a nonaccommodative source.[4] Practically, we find it impossible to separate these two factors preoperatively in most cases or even at operation in some cases of comitant strabismus. Therefore we do not apply the terms mechanical strabismus or tonic strabismus to the cases of comitant nonaccommodative squint since we have no clinical evidence for the separation of the cases into these categories.

The vertical component of the strabismus is considered next. The vertical anomalies are classified as (1) cases due to paralysis of one of the vertical muscles, (2) cases of pseudoparalytic vertical anomalies with overaction of the inferior obliques, (3) cases with comitant vertical deviations, and (4) cases with dissociated innervational vertical anomalies.

The last aspect to be considered is the extent of amblyopia, the type of retinal correspondence, the amount of suppression, and the degree of fusion and stereopsis.

From such a study of the various manifestations of strabismus, the doctors and technicians can arrive at a practical plan of therapy. The cases are divided into those that have a reasonable chance to obtain single binocular vision and those in which only a cosmetic correction of the strabismus is likely to result. In the former, glasses are prescribed to relieve the convergence tone caused by hyperopia, patching is used to overcome amblyopia, and orthoptic treatments are given to overcome anomalous retinal correspondence and suppression. Finally the residual deviation is neutralized by operation. Postoperative orthoptic training is given in all the cases in this group. In general, patients with the accommodative type of strabismus are more likely to obtain single binocular vision and respond to treatment more favorably than patients with the nonaccommodative type. The cases in which only a cosmetic correction of the strabismus is likely to be obtained are sometimes given similar therapeutic measures as a trial. In a few instances we have been surprised to find that some have responded well. Usually, however, surgery is the only therapy of value in these cases.

A standardized method of analysis of ocular motor anomalies is not only of immediate use to the patient, doctor, and orthoptic technician but is also valuable in obtaining uniform records that can be analyzed statistically. One of the present problems in ophthalmology is to gather sufficient data from which to evaluate the various therapeutic measures used in the treatment of ocular motor anomalies. Routine use of a standardized method of analysis will provide information to answer these problems objectively.

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Discussion of Dr. Owens's Paper

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Dr. Owens' interesting paper has brought out one of the most vital factors necessary for the successful practice of orthoptics. That is, having an organized method of examining and treating ocular motor anomalies. For successful work a thorough routine examination is essential and should be made of each patient with these abnormalities. This examination should include the information necessary to an analysis from which a correct diagnosis and outline of treatment can be taken.

Present-day orthoptics demand this analysis in order that cases may be classified and that treatment may be directed to the factors involved. After the patient has been classified as to type of case, treatment suited to the individual can be selected. I feel certain that technicians are striving to recognize the different procedures required for each type and individual. To attempt to treat two different types of abnormality in the same manner would not only be unsuccessful but disastrous. When cases are analyzed, such unfortunate experiences do not occur. It is not true that by analysis and direct treatment

every case results in a cure, but a greater percentage of cures can be achieved in this manner. If cures have been accomplished without analyzed and specific treatment we shall certainly have to lay it to luck, or to the fact that we were treating a rare type of case in which almost any kind of treatment could affect a cure.

As Dr. Owens has stated, the method of analysis need not be complicated, but it should be as simple, thorough, and comprehensive as possible. Certainly an analysis of the findings of each case should be made, and periodic consultations between ophthalmologist and technician regarding procedures should be held. With such helpful instruments as Dr. Owens' fixation light, a major amblyoscope, the four-dot test, and like devices, examinations that have been difficult can be made quite easily. Much can be ascertained from these tests both subjectively and objectively.

In analyzing strabismus cases, we have found in our work that a detailed examination and history greatly repay the time required for them. Important indications as to the necessary procedures and the final results depend on information concerning the age at which the squint occurred, duration of the squint, and the age at which the patient is examined. It is desirable to learn if fusion is present, for this knowledge can help to determine whether surgical procedures should be radical or limited. It is well not to depend entirely on motor findings nor entirely on the sensory aspects in determining procedures, as the clinical picture may change with the development and improvement of either one. Age is of importance, especially in very young patients in whom a paresis has shown an almost constant improvement, thereby changing the amount of deviation.

There may be various opinions regarding the grading of binocular vision but the vital factor is to recognize bimacular fixation as necessary to normal retinal correspondence and to develop sufficient fusional range for maintenance of comfortable binocular vision.

In analyzing strabismus cases we divide them into three types for treatment: Accommodative, nonaccommodative, and part accommodative-part nonaccommodative.

Accommodative squints require glasses and orthoptics only for correction.

Squints of a nonaccommodative origin measure practically the same for near and distance. These do not require glasses, but do need surgery and orthoptic training. Among the nonaccommodative types are those squints in which such anatomic factors as faulty insertion of the muscles are involved. These cases seldom respond successfully to orthoptic treatment but depend almost entirely on surgery for correction.

Cases with excessive innervation are classified as part accommodative-part nonaccommodative since the deviation is usually higher for near than distance. A majority need orthoptic training for correction. Refractive errors, if present in these cases, are usually slight. Surgery may be required for the nonaccommodative part, while training similar to accommodative treatment is needed for the excessive innervation even though this factor is not refractive in origin.

Although the various classifications and terms used by different schools have brought about much confusion, a knowledge of the essential differences in each case can direct the orthoptic technician to select the treatment that will give successful results.

Being able to recognize such essential points as the effect, if any, that refraction has on the deviation, what anatomic factors are involved, whether the case belongs in the excessive-innervation group or among the cases of incomitance will contribute toward correct diagnosis and successful treatment.

Continued progress in orthoptics depends to no small extent upon our careful analysis of each individual case in order that we may gather facts with which to further our knowledge and therefore increase the percentage of cures we are able to achieve.

511 Medical Arts Building (3).

NOTES, CASES, INSTRUMENTS

THE SINISCAL LID PLATE*

A NEW INSTRUMENT

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A new type of instrument for retracting the upper (or lower) eyelid during entropion and various other operations is presented herewith (fig. 1). It is hoped that this will fill a long-desired need in the ophthalmologist's armamentarium for a type of instrument that is simple to use and that will keep the eyelid well reflected and open to view for surgical procedure without tearing into the delicate lid tissues and traumatizing them needlessly.

Fig. 1 (Siniscal). The new type of lid plate.

Although particularly adaptable for use in lid surgery, especially for performing the modified Ewing operation for cicatricial entropion,† the instrument may also be used for other surgical procedures with a minimum of trauma to the lid structure and of discomfort to the patient, notably, in the operation for removal of wild hairs in districhiasis, in the surgical removal of imbedded foreign bodies of the conjunctiva (vide infra), and in some plastic operations of the eyelid that require working on the widely exposed conjunctival surfaces, particularly in ptosis operations where shortening of the levator is done (Blascovics).‡

The new instrument (fig. 1) is an outgrowth of the older trachoma lid forceps, used mainly for the removal of the tarsus, which consisted essentially of a flat, round, convex plate on one blade, and of a "biting" or toothed tip on the other end (or blade) of the forceps (fig. 2).

This older instrument was found to be unsatisfactory, since it tore into conjunctival tissue because a good deal of pressure on the closing blade was required to maintain fixation. Furthermore, it did not properly expose the eyelid for retraction because at the point of the "bite" a wrinkling or notching of the lid margin was caused, and this interfered with the path of the knife during incision and also crowded the line of incision at this point (fig. 2).

A later development on this older instrument consisted in neglecting the use of the toothed blade entirely, simply inserting a traction suture at the center of the lid margin, and winding the ends around the forceps post, meanwhile reflecting the lid over the upper toothed blade which was closed and locked.

Further modification was to cut off the toothed blade from the convex blade and simply use the latter, with the screw bind-

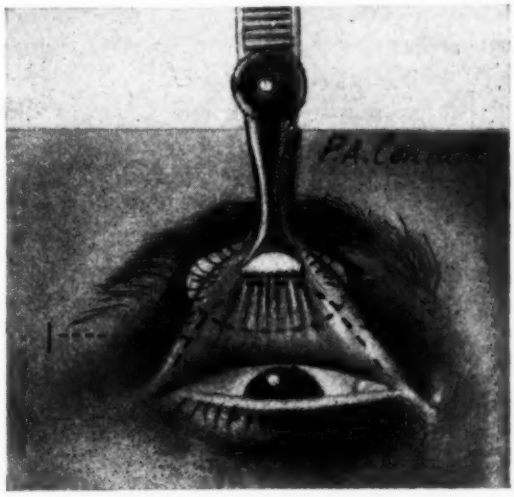

Fig. 2 (Siniscal). Showing old type of lid forceps with biting end tearing into conjunctiva at point of traction. (1) Line of incision for entropion operation. Observe that rounded, convex plate does not afford complete lid counterpressure.

* From the Missouri Trachoma Hospital.

† Smith, J. E., and Siniscal, A. A.: Am. J. Ophth., **26**:382 (Apr.) 1943.

‡ Suglian, V. V.: Bulletin of Practical Ophthalmology, Green's Eye Hospital, **12**:7 (Jan.) 1942.

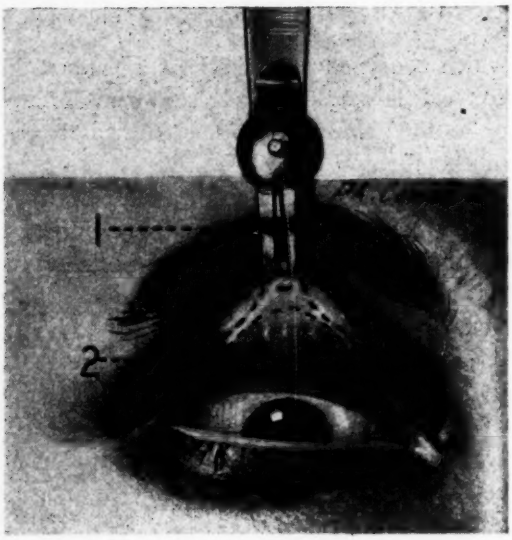

Fig. 3 (Siniscal). Showing new lid plate in use with concave blade extending into corners of reflected eyelid. (1) Traction suture. (2) Line of incision. Observe that new concave plate affords better support by counterpressure for complete line of incision. Concave edge adapts blade to convexity of eyeball.

ing post left intact. This modified instrument was used at the Missouri Trachoma Hospital for many years, with fairly satisfactory results. However, I did not find the convex edge of the lower or supporting blade, or plate, to be best suited for exposing the reflected conjunctiva properly for incision and surgical maneuver.

The new instrument has a larger and somewhat longer plate (or blade), with the presenting edge made *concave* instead of *convex* as in former instruments; the "biting" or toothed end of the forceps has been eliminated entirely so that, instead, a simple tension-spring binding post is used for winding and entwining the ends of the traction suture. As a matter of fact, this instrument is not a forceps at all, since it has only one blade which is an extension of a suitable, weighted handle (fig. 1). It is more correctly called a lid plate.

Figures 3 and 4 show illustrations of the instrument in use, with the upper eyelid reflected well back over the upper surface of the blade or plate, and with a single traction suture inserted through the middle of the lid margin, thus affording a wide exposure of the conjunctival surface when this suture is drawn upward and backward toward the handle of the instrument, and then wound securely around the binding post.

Aside from the simplicity of this new instrument, and its ease of handling, there is an important advantage gained in using a concave-shaped blade, instead of the older, convex-edged type. The latter may afford a fairly good exposure and counterpressure to incision at the broad portion of the lid proper, but it failed short in this purpose at the *corners* of the eyelid.

Here, because of its short, blunt, convex edge the older instrument did not afford sufficient support and retro-exposure for completing the line of incision medially and laterally.

In the new instrument, the elongated concave edge is thus shaped to adapt itself more readily to fit into the retrotarsal fold of the lid (on the dermal side) and because of its wider spread can reach into the corners

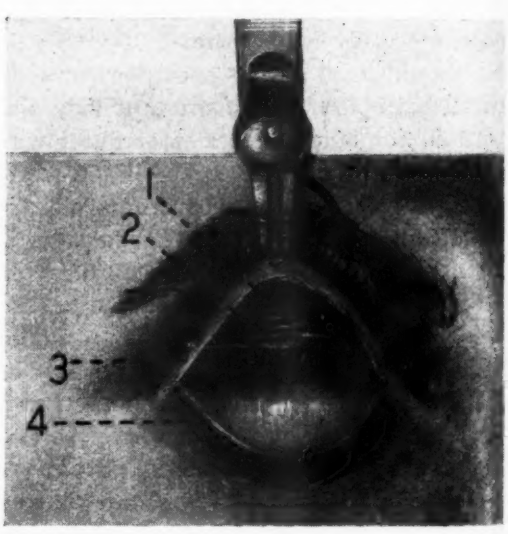

Fig. 4 (Siniscal). Showing new lid plate in use for Blascovics type of ptosis operations. (1) Exposed circular fibers of orbicularis muscle. (2) Detached lid margin. (3) Exposed vertical fibers of levator muscle. (4) Detached portion of conjunctiva and tarsus, stripped from underlying musculature and reflected downward. (Mattress sutures on edge of latter are not shown.)

(angles) of the lid and afford better support by counterpressure when incising the lid at the inner and outer canthal regions.

Furthermore, the newly shaped blade circumvents slipping or "sliding" of the instrument while in use, since its concave edge engages itself aptly into the dermal fold of the reflected eyelid. Slipping and sliding of the older instrument was a fault that frequently caused interruptions and replacement of instrument during operation.

The presence of the spring under the rounded nut on the binding post is to afford tension when the traction suture is entwined (instead of tied) around this post. The nut is turned to the desired tension on the spring, and left in the same position throughout the operation; the traction suture should be wrapped around the post tightly and snugly, and, during the course of the operation—as the need may arise—the suture may be unwound and then reapplied for securing a firmer grip, if so desired.

Although some operators prefer to use three traction sutures during lid operations in place of one, I have found that one suture is usually sufficient for cicatricial entropion operations and for most other procedures requiring repair work on either the upper or lower eyelid. When three sutures are preferred, they may all be wound around the common binding post.

When used on the lower eyelid, the instrument is applied in the same manner, from below, with the blade or plate inserted into the retrotarsal fold and a single, central, traction suture placed through the ciliary margin to retract the eyelid downward over the plate and thus keep it exposed for operative work.

Aside from its use in operations for cicatricial entropion, the new lid plate may also be used for the removal of deeply imbedded foreign bodies located in the inner recesses of the conjunctiva. A small B-B shot was thus removed from the folds of the conjunctiva of a child's lower eyelid. With pressure of the plate applied from the dermal side of the lid, and with widening of the tract of entry on the conjunctival side, the small shot was expressed without difficulty.

Again, during electrolytic epilation operations, it was found that the point of the cautery needle could be more easily directed to the base of the affected cilium when the lid was folded back over such a lid plate and held firmly in place with a traction suture. Since the cilia to be removed are those which have become incurvated or directed toward the cornea, these will appear to stand straight up when the eyelid is retracted, and thus will be more readily accessible.

In another operation, following injury to the eye from a caustic, the lower eyelid was kept well retracted over the new lid plate by a central traction suture; this afforded a wide exposure of the floor of the orbit for the removal of a subtotal symblepharon.

Restoration of the lower sulcus of the orbit was facilitated by retracting the lower eyelid and ciliary margin during the preliminary dissection of the conjunctival flap and insertion of the sutures.

In the Blascovics ptosis operation (fig. 4) the new lid plate will supplant the old type of lid clamp which tears into the ciliary margin from tension during the operation. The new instrument may also be used for tarsectomy and tarsorraphy, or for any procedure for which the older trachoma lid forceps was used. Other applications of the lid plate will suggest themselves to the ophthalmic operator with the subsequent use of this instrument.

Trachoma Hospital.

CHRONIC SIMPLE GLAUCOMA AND THE LABILITY TEST

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Recently, Bloomfield and Kellerman* reported their results with several tests

* Bloomfield and Kellerman: Am. J. Ophth., **30**: 869, (July) 1947.

usually employed for the early detection of chronic simple glaucoma. Prior to this, Bloomfield and Lambert† described fully their method for testing the lability of ocular tension. This method consists in the application, at the same time, of the cold pressor and the jugular compression test. The former investigators reported the apparent superior value of this provocative lability test as a diagnostic procedure.

Results

The convincing soundness of the report prompted the present investigation. This consisted of the use of the lability test in early established cases of chronic simple glaucoma. Thirty-one patients were examined; all 31 gave a positive response according to the criteria described by the authors. The results conclusively corroborated those of the originators.

Comment

The lability test, as a dependable diagnostic procedure, is of unquestionable value. Speaking for it is the factual simplicity of its execution and interpretation, as well as its time-saving element—an item in a busy office.

Although the number of investigated cases was small, all, or 100 percent, showed positive results with the lability test.

The procedure is being recommended as a superior routine provocative test for the detection of early glaucoma.

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OPHTHALMIC SMALL BANDAGES*

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It is surprising how little the so-called ophthalmic small bandages are known and still less used. Even in the chapter "Bandages" of the Handbook of Graefe-Saemish, they are not mentioned. Their importance, however, cannot be disputed.

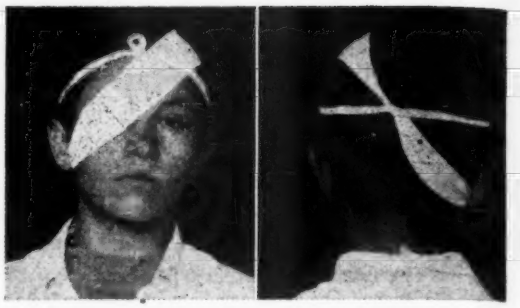

Fig. 1 (Gát). A crossed small bandage.

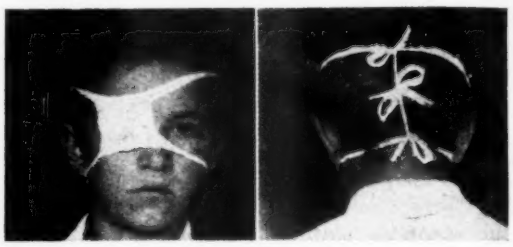

Fig. 2 (Gát). The sling bandage.

The University Eye-Clinik in Debrecen, according to the traditions of the Blaskovics school, used the different kinds of small bandages extensively. Correctly applied they are sure and immovable. A skillfully applied small bandage, with a 80 to 120 cm. swathe, holds more safely and covers better than the monocular bandage used generally.

The most simple is the bandage that we call a "crossed" small bandage because the two branches of the band are crossed over the occiput. First of all, we put gauze and cotton on the eye and then the bandage is applied, its two branches crossed on the occiput and tied on the forehead. It is simple and holds well for 24 hours, even when the patient is bedridden. In general medical practice, this bandage is to be recommended. A strip of material 8 to 10 cm. in breadth and 120 cm. length is enough for this purpose (fig. 1).

The second bandage, more complicated, is the sling bandage. For this a band of 8 to 10 cm. in breadth and 80 cm. in length is

† Bloomfield and Lambert: Arch. Ophth., **34**:83, 1945.

* From the University Eye-Clinik, director, Professor Kettesy.

necessary. We split the two ends so that the middle part (8 cm.) remains intact. This middle part is placed on the eye. The split upper band parts are knotted above, the lower ones below the occiput. The two strips are tied together just in the center of occiput, thus avoiding their slipping down (fig. 2). Although, with the crossed small bandage, a displacement can happen or the gauze and cotton may slip down, with the sling bandage, this does not occur.

University Eye Clinic.

REFRACTION CLINIC*

DISCUSSION BY

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These two cases deal with keeping people relatively happy with old glasses, rather than in making people unhappy with new glasses. This is a negative approach rather than a positive one. A lesson may be learned in the practical management of such cases.

CASE 1

The first patient is a woman who is 79 years of age, and she has not had her glasses checked in 25 years. Her right eye was lost at the age of four years from "scarlet fever," and other than for some early lens changes, the left eye was normal.

She was wearing: O.D., balance lens; O.S., −0.75D. sph. ⌒ −1.25D. cyl. ax. 55° = 20/100+; addition, +2.00.

She was refracted with considerable care because we noticed that she was able to get with a subjective examination: O.D., anophthalmus; O.S., 20/200; with a −1.50D. sph. ⌒ −1.25D. cyl. ax. 80° = 20/40 slowly; addition, +2.50. Pinhole does not improve further. So, these glasses were prescribed, and the doctor assured the patient that she would be happy because, with her new glasses, she should be able to see better.

One month later, the lady returned complaining that she was having bifocal trouble which she did not have before. "The segment was a little bit higher than in her own lens," and it "kept getting in her way." The glasses were checked for power, and the refraction rechecked. Both were found to be correct, and the patient was referred to the optician for adjustment of her glasses.

She was again seen with multiple complaints referable both to conjunctival irritation and her new glasses. She was given some collyrium for the conjunctivitis, and again reassured about her glasses.

And three weeks later, she again returned with many complaints attributable to her glasses. Again refraction was rechecked. The glasses were found to be correct.

DISCUSSION

In general, it may be said that if a person wears her glasses for a long period of time, she will be more resistant to any sort of a change made. One, then, has to weigh whether the added visual benefits will offset the required various new adjustments, such as judgment of distance, new frames, and new strong lenses.

If the patient's symptoms are not specifically and entirely tied up with the need for a change in glasses, it is frequently better to make no change at all. Sometimes, even three lines of vision are better sacrificed than to reintroduce the patient to the new adjustments which different glasses make necessary.

In this particular case, where the patient wore her present glasses for 25 years, we have such a situation. Another factor in this case resolves itself about the fact that she has been able to wear her glasses for this period of time. This is probably due to two factors:

First, she was wearing 0.75 diopters less myopic correction than she requires. This would serve to give her a comfortable work-

*From the House Officers' Teaching Clinic, Massachusetts Eye and Ear Infirmary.

† Director of Department of Refraction.

ing near range through her distant glasses for most of her occupations; for example, eating, washing dishes, and so forth.

Secondly, this undercorrection would tend to express itself in the form of a stronger presbyopic correction for near; thus 0.75 diopters of uncorrected myopia would tend to increase her near vision. Since the reduction of vision in such cases is very gradual, she may not have noted or missed that her distant vision was particularly failing. And also, her needs for greater distant vision is not as great as in a person who leads an active, outdoor life.

I do not mean to infer that one should never change glasses in old people. But if you are in doubt, you frequently get into less difficulty if you do not change the glasses. Since the patient could not make the necessary adjustment, her old lens was reinserted. She was told to keep her new lenses for possible future use. Sometimes, a person who resists a new glass in favor of her old glass, finds that when the old lens is again used, it doesn't equal the new glass in its suitability, and then the patient is more willing to go back to the new one. The point I might make in regard to that is "Always try to have the patient keep her old glasses if you make a change." Because, if she has difficulty with the new lenses, she will soon learn by comparison that her old lenses were not as good as she thought they were.

Case 2

The second patient in this group is a woman, aged 70 years. She has been wearing her present glasses for 15 years: O.D. +0.25D. sph. ⊂ −1.0D. cyl. ax. 10°; O.S., +0.25D. sph. ⊂ −1.0D. cyl. ax. 165°; addition, +2.50.

We have no record of how much vision she had with her old glasses, but a subjective examination revealed the following: O.D., +0.25D. sph. ⊂ −1.25D. cyl. ax. 20° = 20/20; O.S., +0.75D. sph. ⊂ −1.5D. cyl. ax. 140° = 20/20; addition, +3.0. And, she could read the finest print. The glasses were changed.

Four months later, she came into the hospital complaining that she was unable to wear her new glasses because of the discomfort they produced, and that she finds considerable relief when she puts on her old glasses. The examination of her eyes, other than for retinal arteriosclerosis, was not remarkable. The glasses were rechecked, and it was found that with them, she had 20/20 vision.

The refraction proved correct, but a note was made that the interpupillary distance of the new frames was considerably greater than that of the old ones. So, she was referred to the optician to correct the situation.

Two months later, she again returned, insisting on having her money back. She was unhappy with her glasses, and had fixed ideas about their strength, and the note at the bottom of the record read, "Everybody would be happier if the glasses had not been changed." Here, again, we have a person who has worn her glasses too long, who is too set in her habits, and at home, even though the visual acuity was improved, found it difficult to adjust herself to the new glasses.

Discussion

It is just as well to explain that, when a person reaches the arteriosclerotic age, they do not learn new tricks easily. If no harm is done by not changing the status quo too much, no treatment may be as good a treatment as any. You prescribe a little zinc, and let the next fellow change the glasses.

Questions

House Officer: Is it not true that these people may have had difficulty with their eyes that led them to have the prescription for their eyes checked?

Dr. Sloane: I am told that, in both cases, the patients admitted that they were told that it was advisable to change their glasses after such a long period of time.

House Officer: How long a period of time does one have to wear glasses before they reach this "resistant-to-change state?"

Dr. Sloane: I would say 10 years or more would make me wary.

House Officer: In Case 1, if 20/100 vision is considered a serious blurred state, wouldn't it be better to improve her distant vision some?

Dr. Sloane: Perhaps, half way, such as giving her −1.12 instead of −1.50.

House Officer: In view of the difference in the first case of the sphere and in the axis of cylinder, would you not attempt ordinarily to correct this patient, and take your chances that the patient would be happy?

Dr. Sloane: Everybody is clever in reasoning post hoc. I probably would have tried to evaluate her symptoms in terms of "need for change of glasses," and if the symptoms were not visual, I probably would not have changed her glasses.

As far as axis of cylinder is concerned, by wearing her cylinder at the wrong axis, an artificially produced oblique astigmatism was present for which she had had an adequate number of years to make allowances, and, if you change the axis to the correct position, you may be introducing a new criterion of judgment to which she must adjust.

Frequently, you will have a person who has a strong cylinder, for example, at axis 105°, and they have never worn glasses before. They never complain without glasses that vertical lines are tipped, because they interpret this position as the normal straight position. When you give them the correct glass, one of the first symptoms they complain of is, "that everything that is straight is now tipped," and they must make an adjustment to this until it corrects itself.

There is another point on the old lady. A cylinder that is not at the correct axis in a younger person may induce an accommodative effort in order to correct the blur, and this accommodative effort will produce fatigue. The wrong axis will make for eyes blurring. In a person of this age without any accommodation, no effort is made to correct this blurring, so that she has the blur without the fatigue.

House Officer: Assume that you had prescribed the above glasses, how long would you insist that the patient try to become adjusted?

Dr. Sloane: Since some patients can adjust themselves, one should insist as long as they honestly believe that they are gaining ground. You can easily determine by talking to the patient whether they are ever going to get used to them at all. I believe it is fair to say to the patient that it is to her advantage to get used to the new glasses, because that in itself may be the incentive that will make it possible.

243 Charles Street (14).

ETIOLOGY AND THERAPY OF ACUTE RETROBULBAR NEURITIS*

Lo Wen-Bin, M.D.
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Acute retrobulbar neuritis is not a rare disease in China and we have had here about nine cases a year at this hospital. It is difficult to get a clear opinion about the frequency of acute retrobulbar neuritis; it may be that this disease alarms the patients and induces them to go earlier to the hospital than patients with other diseases, who come as a rule very late to see a doctor, often waiting for months. The frequency of retrobulbar neuritis is especially striking as in China we have apparently no multiple sclerosis, which occurs frequently in Europe. The etiology of retrobulbar neuritis in China is especially obscure. The rhinologic factor, causing an inflammation of the optic nerve is not usually found. Rhinologic therapy—such as the application of a swab

* From the Eye, Ear, Nose and Throat Hospital.

soaked in adrenalin or cocaine, scarification of the concha or opening of the ethmoid cells—does not, as a rule, bring any relief. According to Ernst Fuchs, acute retrobulbar neuritis frequently shows the same type of inflammation of the nerve as the neuritis of the nervus facialis or abducens or sciaticus. These cases were formerly called, and probably rightly so, rheumatic inflammations.

Although there is no multiple sclerosis in China, there are cases of recurring acute retrobulbar neuritis as, for instance, that of a patient, aged 25 years, who had retrobulbar neuritis in the right eye and, later, temporal pallor with normal vision. Recently, he has suffered from severe retrobulbar neuritis of the left eye. A similar case of recurrent retrobulbar neuritis was seen lately by Prof. Adalbert Fuchs in Nanking.

Report of a case

A colonel, aged 38 years, had severe acute retrobulbar neuritis 10 years ago in both eyes. The left eye had become affected a month after the right. His vision at that time was 6/60. He recovered without treatment in seven months and his vision became 6/6. In August, 1946, his vision in the right eye dropped in one day from 6/6 to hand movements. The eye was tender to touch but there was no pain on motion. A week later the left eye also became involved, and he could only count fingers.

A careful general examination did not reveal any etiology and search for evidence of multiple sclerosis was absolutely in vain. In September, he was given penicillin and he became able to read J8. In October, the tonsils were removed and the ethmoids opened. Four days after the operation the vision improved somewhat and he saw, with the right eye J5, and with the left eye, J2. Later on the vision improved a little and in May, 1947, his vision was: 6/8, J1, O.U. The right papilla was a little pale on the temporal side, the left normal.

Although this case improved somewhat after the operation on the nose, it is not certain that it was really caused by an empyema or chronic inflammation of the ethmoidal cells, especially as nothing was mentioned of any local change or of any secretion.

Therapy of retrobulbar neuritis

The therapy of retrobulbar neuritis is somewhat different in China from that used in Europe. We cannot use diaphoresis which proves so valuable in other countries. This is due to different causes: (1) The Chinese do not like to perspire. (2) It is difficult to make them perspire. (3) The facilities for inducing perspiration, such as bathrooms, steambaths, heat boxes, light-baths, and so forth are lacking in most places in China.

Because of these mentioned contraindications, typhoid vaccine has been chiefly favored throughout this country as a form of fever therapy; an initial dose of 5,000,000 bacilli is injected intravenously with a subsequent increase of 50 percent in dosage. The fever occasionally rises to 39°C. and often reaches only 37.5°C.

Milk injections are rarely used in China, apparently because the Chinese react very little to milk, even after 10 cc. have been injected intramuscularly. The cause of this resistance is perhaps the fact that the milk is not a mixed milk as in Europe and comes mostly from one cow and is boiled immediately so that no germs can proliferate in the milk. Injections of 5 to 8 cc. of condensed milk prove very useful, however, if taken directly out of the tin without further boiling. Condensed milk is easily available even in small places in China. These injections give a strong fever reaction with considerable certainty.

Acute form of disease

We recently had a very severe case of acute retrobulbar neuritis of unusual appearance in which the therapy had a striking result.

Case report. A Chinese woman, 51 years

of age, felt slight visual disturbance in the right eye six days before examination. Her vision dropped in three days to hand movements at 30 cm. She was admitted to our hospital. At that time she had slight pain on moving or by touching the eye. The papilla showed a typical choked disc with hyperemia, blurred margin, engorged veins, small hemorrhages, and a mushroom-shaped elevation of three diopters. The left eye was normal. Vision was: O.S., with a +1.0D. sph., 6/6.

On the next day only light perception was noted. On the second day after admission she was given 5 cc. of milk intramuscularly. The day following both light perception and light reflex of the pupil had vanished. An injection of 10 cc. of milk was made on the fifth day and produced a high temperature but no improvement in vision. Two days later 5 cc. yatren-casein was injected intramuscularly. The light sensation and light reflex of the pupil had not been present for three days. The disc showed an increased amount of hemorrhages. This was perceived on the seventh day after admission. Three days later, another 5-cc. dose of yatren-casein was given.

On the 12th day after admission, light perception reappeared, after not having been present 7 days. This was 4 days after the first injection of yatren-casein. She could count fingers on the temporal side at 12 cm. On the 14th and 16th days, another yatren-casein injection (5 cc.) was given. After this she could count fingers at 20 cm.; while standing at 6 meters she could see movements of the leg in the inferior part. From the 19th to the 38th day after admission, she was given 1 cc. of yatren-casein every day. Vision improved slowly. On the 29th day, a central scotoma could be found with the perimeter. The outline of the papilla became gradually distinct and the swelling disappeared. She was discharged on the 38th day after admission. The vision of the right eye was 6/15 and the papilla appeared normal, except that in the neighborhood of the disc there were a few small superficial hemorrhages. Two weeks later vision was 5/10.

Discussion

This case differs from the cases of Dr. Fuchs in its clinical appearance. The disc was not normal but appeared like a very badly choked disc with high elevation and many hemorrhages. Acute retrobulbar neuritis sometimes shows a marked papillitis, but such a highly choked disc is rare. That was the reason we did not make the correct diagnosis at first. We searched for a brain tumor, but the absence of headache, vertigo, and vomiting made a brain tumor very unlikely. Tenderness of the eye led us to the final diagnosis.

2. Against a diagnosis of choked disc in the common sense spoke the development of perfect blindness and absence of light sensation, which never develops so quickly in a common choked disc due to the increase of intracranial pressure. The patient did not become blind as quickly as the cases of Dr. Fuchs.

3. The milk injections did not show any change of the vision but the use of high doses of yatren-casein forte, which was given us by Professor Fuchs, produced an improvement of vision, light sensation appeared and pupillary reaction was visible when the light was directed from the temporal side. The improvement was slow at first and became more rapid. Finally when the vision had reached 6/12 we stopped the injections because the medicine had run out.

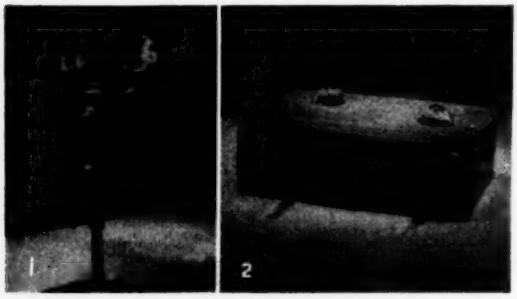
Intramuscular injections of yatren-casein are usually given in small doses (1 cc.) intramuscularly. Even cases which are quite resistant to ordinary therapy and come rather late, react very well to this therapy.

Eye, Ear, Nose, and Throat Hospital.

A PHANTOM FOR ANIMAL EYE SURGERY*

ALFRED A. STONEHILL, M.B.
Chicago, Illinois

Figures 1 and 2 represent eye phantoms in common usage for training in pig-eye and cat-eye surgery. The first (fig. 1) is a modification of the Vienna mask which operates by grasping the optic nerve of the eye. A screw arrangement draws the eye into a conical wire basket and also permits the tension to be varied. The second (fig. 2) was designed by the late W. A. Fisher.† In this



Figs. 1 and 2 (Stonehill). (1) Modification of the Vienna mask which operates by grasping the optic nerve of the eye. (2) Designed by Fisher, this type of phantom uses a suture to hold the eye in position.

phantom, a suture is placed through the optic nerve, and the thread is passed through a hole in a cigar box and attached to a wooden rod which protrudes through both sides. As the rod is rotated, the suture is tightened and the eye is held in position.

In our experience the mechanical-type phantom is cumbersome to adjust and requires considerable time to insert material. The eye is not held tightly, nor can it be placed in any desired position. Securing eyes in the Fisher phantom is also a laborious and time-consuming procedure. The human face is not simulated and the eye is unsteady and difficult to fix.

Figure 3 shows a phantom in which the holding device is a vacuum cup. To this is attached a short piece of rubber tubing and a soft rubber bulb. The bulb is squeezed; the eye is inserted in the cup in any desired position and held in place by negative pressure when the bulb is released. The eye is quickly removed by pressing the bulb which still contains sufficient residual air to force the eye out of the cup. A small wire guard prevents the eye from entering too deeply into the cup.

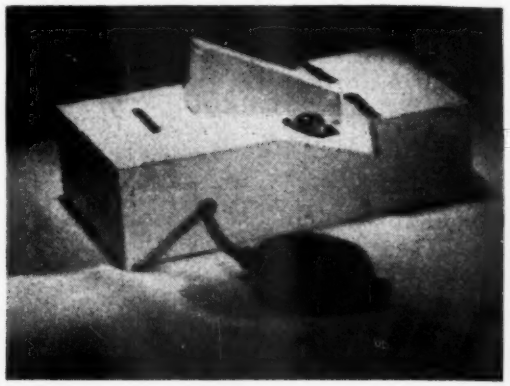


Fig. 3 (Stonehill). The holding device in this phantom is a vacuum cup.

The face consists of a cigar box modified to exaggerate facial contours. A deep orbit is simulated and the obstruction of the forehead and nose is present. These are constructed from cardboard.

The rubber cup is a crutch tip (size 19) and is available in many sizes. To it is attached a short piece of rubber tubing, using a metal connector or rubber cement. The rubber bulb is standard, but valves must be removed and the inlet hole closed with an appropriate plug. These can be obtained from a penicillin or vaccine bottle and cemented in place.

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* From the Harlem Eye and Ear Hospital, New York City.

† Fisher, W. A.: Cataract, Senile, Traumatic, and Congenital. Chicago, Chicago Eye, Ear, Nose and Throat College, 1917, p. 64.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 3, 1947

DR. DANIEL KRAVITZ, *president*

SYSTEMATIC EXAMINATION OF THE EYE

DR. HENRY J. MINSKY discussed this subject during the instruction period.

SOME UNSOLVED PROBLEMS IN SQUINT

DR. FRANCIS HEED ADLER first discussed whether comitance rules out paralysis of a muscle in cases of squint. He said that frank incomitance in the angle of squint is generally regarded as a sure indication that the strabismus is either paralytic or due to an anatomic abnormality, such as faulty insertion of a muscle. The one exception to this is the elevation of an eye in adduction which occurs in some otherwise comitant squints, and which is regarded by most authors as representing the normal preponderance of the inferior oblique over that of the superior oblique. This preponderance is due, according to their point of view, to the fact that the inferior oblique is a longer muscle and has a longer arc of contact.

In considering the question, of whether comitance rules out a paralysis, he said that many authors agree that a squint which was incomitant at its beginning may, with the passage of time, become comitant due to either spasm or contracture of the direct antagonist or of the yoke muscle of the paretic muscle. When the paretic muscle recovers from its paralysis, the comitant element remains.

Dr. Adler said that there is very little proof that this is true. It is of more than academic interest to determine whether it is true or not in that it determines our decision as to the nature of the strabismus in any case; that is, whether the squint is paralytic or innervational and this should considerably alter the prognosis and type of treatment.

Contracture of a muscle may undoubtedly occur in severe paralysis and lead to a comitant element in a squint. In such cases, however, the angle of squint still remains incomitant due to overaction of the yoke muscle. A muscle which was paralyzed may regain sufficient power to move the eye completely in the direction of its action, but as long as any weakness remains this will be manifest by the overaction of the yoke muscle, based on Hering's law.

Dr. Adler said that he had never seen a case of paralysis of an ocular muscle occurring in an adult become comitant. There may develop a strabismus in the primary position of gaze, due to contracture of the antagonist muscle; namely, the internal rectus in a case of external rectus palsy, but the squint is still incomitant, even in partial recovery of the externus, due to overaction of the internal rectus in the opposite eye. This is always a sign of paralysis of a muscle.

No one has examined muscles which are thought to be contractured to determine whether or not they are fibrosed. Further the term "spasm" when applied to a muscle is purely hypothetical. Studies should be made to determine the basis of what contracture of a muscle is, and if possible physiologic evidence should be produced to show that a muscle termed "spastic" is really undergoing spasm. Any paper or book in which such terms are used freely should be examined with caution.

Dr. Adler next discussed the question of whether a horizontal strabismus can arise from a paralysis of a vertical muscle. He said that it seems reasonable to suppose that a paralysis of a vertically acting muscle could dissociate the eyes in the same manner as

inserting vertical prisms before one eye changes an existing horizontal phoria to a tropia. Once the dissociation has become manifest and continued for any period of time it might become permanent. An additional component of the strabismus should be comitant while there should always be elicited some evidence of incomitance.

Dr. Adler then spoke of the meaning of anomalous correspondence. He said that there are two fundamental concepts regarding retinal correspondence. (1) That it is innate, and (2) that it is acquired. The vast majority consider it acquired and that anomalous correspondence arises out of squint, perhaps as an adaptation to the angle of squint. It is a poor adaptation, if this is so, since it could only be effective in normal life in those cases of harmonious correspondence where the subjective and objective angles are equal. In most cases of squint with so-called anomalous correspondence, there is no correspondence. Due to suppression, the region of the retina where the image customarily falls is suppressed and no spot in that retina has the same locus in space as the macula of the fixing eye. It is true that, by training, anomalous correspondence may be broken up and normal correspondence established in many cases.

Dr. Adler then asked whether anomalous correspondence could develop in a case that had normal correspondence. He said that it is possible that anomalous correspondence is innate and due perhaps to some anatomic defect in the arrangement of the visual pathways. From this point of view it might even be considered the cause of squint in large-angle squints. In an analysis of our series, we found that the large majority of squints under 15 degrees had normal correspondence, while over 15 degrees they had anomalous correspondence. A sudden break came at this point. It is possible that the region of the retina beyond the optic disc on the nasal side contains fibers which yield anomalous correspondence, while those between the disc and macula yield normal correspondence.

Principles of ocular muscle surgery

Dr. Rudolph Aebli stated that there are three principles in the surgery of extraocular muscles: (1) To weaken a strong muscle or function, (2) to strengthen a weak muscle or function, (3) to confine all surgery to the particular field or fields involved, and not to disturb those fields of action in which the muscle balance is relatively normal.

Generally speaking, he said, it is good policy not to cripple the function of any one muscle excessively but to spread the operation over multiple muscles; for each millimeter of recession one figures to correct 4 to 5 prism diopters. These results vary and are flexible but are a basis for preoperative calculations of the muscles operated. Thus deviations of 20 to 25 degrees can be corrected by operating one muscle, deviations of 40 to 50 degrees are best corrected by operating on two muscles, and deviations of 70 degrees or more should be corrected by operating on three or more muscles. By adhering to these rules no one muscle is excessively crippled and the movements of convergence and divergence and associated lateral movements are well maintained.

Recession of the inferior oblique of about 10 mm. corrects about 20 degrees of hyperphoria in the primary position, and has replaced myectomy at the origin, as the results can be gauged more accurately.

The fixating eye in the primary position and in the six cardinal fields is important and operative procedures should be varied, depending on the choice of fixation. Thus in nonparalytic convergent strabismus where the right eye fixates in the primary position and in eyes right, and the left eye fixates occasionally in the primary position but constantly in eyes left, there is no limitation of outward rotation of either eye but there is generally a marked inward rotation of the

nonfixing eye. In such cases surgical measures applied to the rectus interni to stop the overaction produce very favorable results. In cases of double elevator paralysis of one eye in which fixation is constantly with the sound eye, it is better to raise the lower eye; in those that fixate with the paretic eye, it is better to lower the higher eye; in those that alternate fixation, it is good policy to divide the operation between the two eyes.

A few remarks on technique are in order. It is advisable not to disturb the normal anatomic relationships and to maintain the fascial muscle envelopes. The sutures hold better and less hemorrhage is encountered. Retraction of the caruncle must be avoided and the supporting structures should not be disturbed. Scleral fixation is not foolproof, and clots and raw surfaces tend to produce adhesions to the underlying sclera with disappointing results.

Dr. Aebli concluded his discussion with slides and case reports illustrating the principles he had discussed and showing errors in technique and in operative judgement.

Diagnostic criteria in surgical management of lateral deviations

Dr. Harold W. Brown emphasized the surgical importance of an accurate diagnosis. He said that if the accommodative convergence and the divergence functions are considered as direct antagonists, the comitant convergent squints can be classified as primary convergence excess, or divergence insufficiency and the relationship or amount of the secondary over- or underaction of the antagonistic function will serve as a surgical guide, as to which functions (convergence or divergence) should be strengthened or weakened. The divergent comitant deviations are classified in the same manner.

Dr. Brown discussed the question of whether the deviation is primarily a divergence excess or a convergence insufficiency. He said that the determination of the amount of secondary overaction of the divergence in convergence insufficiency and the amount of secondary underaction of convergence in the primary divergence excess type, will be the determining factor as to the amount of recession of the externi, or the amount of resection of the interni that should be done to correct the divergent lateral deviation.

In the noncomitant or paralytic lateral deviations, the diagnosis of the paretic muscle is usually evident by the failure of the muscle to rotate the eye fully in its field of action. The cause of this failure may be due to a primary weakness of the nerve, congenital anomaly of the insertion, structural change in the muscle, or limitating fibrous bands in the direct antagonist.

A nerve or muscle weakness will usually show a secondary contracture of the direct antagonist or secondary deviation of its associate muscle in the other eye, or both. Surgery of a truly paralytic type is based on a strengthening operation of the paralytic muscle or a weakening operation of the direct antagonist or the yoke muscle of the other eye.

In those cases where the restricted action is due to a limiting fibrous band in the direct antagonist, such as is found in retraction syndromes, there is usually no secondary contractures or deviations, and the surgical management will depend on the functional integrity of both the muscle involved and its direct antagonist. The range of movement is usually limited and surgery should be confined to shifting that range nearer the primary position.

Lateral squints that show a vertical deviation will call for a careful analysis of the lateral deviations, in terms of both the over and underactions of the disjunctive functions of convergence and divergence, by measuring the deviation of distance and near, and in the six cardinal fields of gaze, for the over- and underactions of the individual muscles. After the diagnosis is made, the surgical correction of the greatest devia-

tion, either the vertical or lateral, and the field where that deviation increases, seems to be the safest surgical procedure.

The variations and combinations of the dysfunctions of convergence, divergence, individual anomalies and their secondary deviations and contractures, and the complicating vertical deviations defy any final standardization of the surgical management of these lateral deviations, based on anything other than a diagnostic analysis of each individual case.

Discussion. Dr. James W. Smith said that Dr. Adler had brought some new and stimulating thoughts on ophthalmic physiology. He said that one becomes confused by authors who use the same words with different meanings. He mentioned the use of such terms as muscle overaction, underaction, spasm, contraction, overshoot, paresis, palsy, partial paralysis, and paralysis. To this array, Bielschowsky has added congenital overaction of the inferior oblique muscle; another contribution made by Chavasse (and stressed by Dr. Adler in a recent paper) is inhibited palsy of the contralateral antagonist. Dr. Adler once again made an appeal for uniformity in eye-muscle terminology.

Dr. Smith said that we diagnose, treat, and operate too late in life to achieve binocular single vision. He stressed the need to educate the general practitioner, pediatrician, and some ophthalmologists to the importance of bringing patients for treatment in infancy and early childhood if amblyopia is to be forestalled. Many patients, who recognize deviations early in childhood, have been dissuaded by their medical advisers from seeking ophthalmic treatment immediately. Most of the cases can then only be improved cosmetically. Only a few are brought for observation early enough to effect recovery of binocular single vision.

Bernard Kronenberg,
Secretary.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

November 18, 1947

Dr. Edwin B. Dunphy, *presiding*

Tumors of the orbit

Dr. Arnold Forrest of New York reported an analysis of 204 cases of intraorbital tumor in the files of the Registry of Ophthalmic Pathology. It was noted that, of the 168 primary tumors, there were 89 masses of mesenchymal origin including those related to connective tissue, to the vascular tree, and to the hematopoietic system. Fifteen mixed tumors had arisen in lacrimal gland. Forty-eight neoplasms were of neurogenous origin and included those arising in peripheral nerve sheaths, meninges, and optic nerve. Eighteen dermoids were noted. In 42 instances of primary intraorbital neoplasm, the tumor was malignant; one third of these patients had a five-year cure. In addition, 24 carcinomas, 6 neuroblastomas, 5 melanomas, and 1 pituitary melanoma noted in the orbit had arisen in a primary site elsewhere.

In the discussion that followed, Dr. Frederick Verhoeff noted that the cylindroma, lymphangioma, and liposarcoma were not included in the classified types.

Dr. Forrest replied that the cylindromas were included in the mixed tumors, and that the specific tumors in the Registry to which Dr. Verhoeff referred as lymphangioma and liposarcoma were placed in the groups of angioma and undifferentiated sarcoma, respectively, since there had not been universal agreement among the pathologists on the question of their differentiation.

Dr. Parker Heath said that it was only by such a series of cases as Dr. Forrest presented and other series that other laboratories are trying to produce that one can really arrive at some sort of good surgical judgement in the management of these cases.

OCULAR HYPOTONY

DR. PARKER HEATH of Boston presented this subject which he defined as: intraocular pressure below the normal for that eye. An arbitrary upper limit is 10 mm. Hg (Schiøtz) or the equivalent. Low pressure is often associated with deterioration of the globe.

Facts and theories relating to cause were discussed with the following headings: contusions, nervous origin, perforating wound and injury, myopia, uveitis, detachment of retina, congenital malformation, general disease states, endocrine imbalance, drug and surgical therapy, and spontaneous causes.

The pathology of hypotony related to severity and duration. Occasional signs are edema of lid; enophthalmos; cornea thickening; wrinkles of cornea; radius of curvature lessens; edema of epithelium; iris congested, cystic at times, pigment movement; anterior chamber deepened; iris angle more right angled; angle trabeculum looser; diameters increased; aqueous plasmoid and contains cells; ciliary body atrophic or inflammed; cyclitic lens change common; scelra thickened; vitreous and aqueous more xanthotic; suprachoroidal space enlarged by fluid; choroid congested or disorganized; retina cystic—pigment migration; detachment often; nervehead edematous, sometimes choked. Clinical significances were discussed.

Dr. Frederick Verhoeff opened the discussion of the paper. He mentioned the hypotony that occurs in eyes with subsiding infection. The eye may have good light projection, so that one hesitates to take the eye out. He had never observed the tension in such eyes to become normal, and he asked Dr. Heath if he knew how to raise the tension in such cases.

Dr. Verhoeff took issue with Dr. Heath, who, he said, apparently agreed with Dr. O'Brien in regard to the great frequency of separation of the choroid 24 hours after the operation. He felt that the appearance is due to indentation of the sclera, since the eye is examined when it is still soft. He personally did not believe separation of the choroid occurs in every case. However, he felt that one does get a separation quite often when there is prolonged low tension. He noted that it was Barkan who first thought the separation of the choroid was due to leak of aqueous through the wound.

In cases in which the choroid did not go back in a reasonable time, he thought a scleral puncture should be done. He mentioned two cases of spontaneous separation of the choroid, one in a low-tension eye. In one case the retina was not separated, the fluid behind the choroid contained very little serum, the patient had had diarrhea for years. In the other case there was also some separation of the retina.

Dr. Verhoeff observed that several cases of choroidal separation have been associated with hypertension with nephritis, which caused trouble in the choroid. He felt that the fact that separation of the choroid does not occur more commonly is proof that aqueous is a secretion, not a transudate, for by simple transudation the fluid could go more easily into the ciliary body, thence to the subchoroidal space, than through the membranes, and so forth to the aqueous.

Dr. William Beetham pointed out that in diabetics studied by Dr. Waite and himself only the ones in coma and with true glaucomas showed demonstrable variations in tension. He thought that an iridencleisis was the operation of choice in chronic glaucoma, especially in older people, since hypotony may develop with the trephining operation.

Dr. Paul Chandler pointed out that in those cases of contused globe with reduced vision, the reduction is due to a refractive error, usually a high astigmatism from pressure of the lids on the cornea. A chalazion of the upper lid may cause pressure on the globe sufficient to cause astigmatism of considerable degree if the intraocular pressure is 15 mm. Hg (Schiøtz) or less.

Dr. Judd Beach asked which comes first,

the hypotony or the uveitis. Dr. Cogan inquired as to where the vitreous goes if there is a separation of the choroid.

Dr. Heath in reply said that myopia was present in one third of the cases with hypotony. In detachment of the retina there may be noted marked reduction in caliber of the blood vessels of the retina. He has the impression from laboratory material that the fluid outside the choroid is transient, while the fluid under a separated retina is more permanent. In reply to Dr. Beach, he thought the uveitis usually came first. In regard to where the vitreous goes, he said the vitreous was mostly water, and this may be resorbed and later replaced by more water, by some process not fully known at present.

Mahlon T. Easton,
Reporter.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

Section on Ophthalmology

December 18, 1947

Dr. Burton Chance, *chairman*

Mixed-cell tumor of lacrimal gland

Dr. I. Edward Rubin (by invitation) presented a follow up on a case of mixed cell tumor of the lacrimal gland which was presented to this society one year ago.

Case Report. F. Y., a 36-year-old white man, developed a tumor of the left lacrimal gland at the age of 10 years. The tumor was excised when he was 16 years of age and was reported to be a "mixed tumor" of the lacrimal gland. It recurred 11 years later, when the patient was aged 27 years, and failed to respond to a full course of X-ray therapy. A retrobulbar tumor mass was removed from the left orbit of the patient now aged 33 years. Again, the pathologic report was "mixed tumor" of the lacrimal gland.

The tumor soon recurred, producing complete ptosis of the left upper lid and a moderate proptosis. In March, 1946 (age now 35 years), papilledema of the left nervehead was first noted and an intracranial extension of the tumor was feared.

In July, 1946, at the Graduate Hospital, Dr. Robert Groff performed a left frontoparietal craniotomy and found no intracranial extension; but the left orbit was filled with tumor tissue which compressed the left optic nerve. Dr. Groff removed most of the tumor. The pathologic report was adenocarcinoma.

Two weeks later in August, 1946, Dr. Edmund B. Spaeth exenterated the entire left orbit. This was followed by large dosage X-ray therapy, and the patient developed marked X-ray sickness.

In January, 1947, six small metastatic nodules were noted in the left scalp under the skin. X-ray films now disclosed a small area of metastasis in the left sphenoid bone. The exenterated socket granulated well, with no recurrence of tumor lesions in the socket at any time. In March, 1947, X-ray studies revealed metastases in the left frontal bone. In June, 1947, the patient had a severe spell of vertigo, falling to his right side and vomiting. Then he had frequent episodes of speech aphasia with loss of memory and with weakness in his right arm.

Examination disclosed paralysis of the left fifth cranial nerve including the motor division, diminished right corneal sensitivity, slight deafness in the left ear, weakness of the right arm, slight dyssynergia of the left arm, and an ataxic gait. X-ray studies now showed further metastases to the left sphenoidal ridge and to the posterior portion of the left ninth rib. A spinal tap revealed clear fluid under normal pressure with a heavy globulin reaction, and a colloidal gold curve of 5,443,322,000. A ventriculogram was negative, but metastases to the left cerebrum and to the posterior fossa were strongly suspected.

The patient steadily went down hill with frequent episodes of speech aphasia and

with progressive weakness of his right arm and his right leg.

During all this time his right eye remained normal, although possibly the retinal veins and arteries were slightly more full and slightly more tortuous than they had been one year before.

A few days before death he became drowsy and developed a paralysis of the right sixth nerve. He died in a coma August 29, 1947. Autopsy permission was refused. The immediate cause of death was thought to be due to increased intracranial pressure, which in turn was due to cerebral metastases.

This case well illustrates that mixed tumors of the lacrimal gland tend to recur if followed long enough and that they tend to become malignant. These tumors have a strong tendency toward bony invasion. Roentgen therapy has little effect on this type of tumor. If the tumor invades the soft tissues of the orbit, immediate exenteration is indicated. If there is bony involvement, a complete bone resection of the involved osseous portion is advisable. Finally, the best surgical approach is through the roof of the orbit by a frontal bone flap.

(I wish to thank Dr. Spaeth again for giving me the privilege of presenting this interesting case.)

Discussion. Dr. I. S. Tassman: Mr. Chairman, may I present a case, which in several ways is similar to the case that was presented by Dr. Rubin a year ago, and again with a final report tonight.

This case first came under my observation at the Wills Hospital a little over a year ago. However, the patient had attended the clinics at the Wills Hospital since 1934—a total of nearly 14 years. In 1934, he first noted a swelling of the left upper eyelid over the region of the lacrimal gland. An excision of the mass was done at that time. There was a recurrence, and a second excision was made in April, 1938. There was another recurrence. He returned in 1943, when the mass was again excised; in July, 1945, when there was a similar recurrence and again an excision of a portion of the mass. A biopsy was done each time. The laboratory report from Dr. Perce DeLong was "a mixed tumor."

In October, 1946, the patient again returned, and that was the first time that he came under my observation. He suffered another recurrence of a mass over the lacrimal gland on the left side.

This slide (showing slide) presents the general external appearance of the patient, showing a ptosis of left upper eyelid and the swelling over the upper, outer quadrant of the left orbit. Again we excised some of the mass for biopsy, and this time the report from Dr. DeLong in the pathology laboratory at Wills Hospital was, "tumor cells that are definitely adenocarcinoma."

An exenteration of the orbit was then done. The mass in the upper eyelid, and the infiltration of the soft tissue of the orbit were diagnosed by Dr. DeLong as adenocarcinoma. There was apparently no involvement of the bones of the orbit. At the present time the patient is still living and well, and in apparently good condition.

I believe this is another case of mixed tumor which, after a period of years, became malignant and was found to be an adenocarcinoma of the lacrimal gland.

Teratoma of the orbit

Capt. Frederick Harbert (MC), U.S.N. (by invitation) spoke on this subject and gave a case report.

Congenital tumors are classified embryologically according to the number of germ layers from which the tumor is derived. Thus osteoma, angioma, and so forth, are derived from a single germ layer. Dermoids are characterized by tissue derived from two germ layers; namely, ectoderm and mesoderm. These are characterized by the presence of squamous epithelium and derivatives from it, such as hair, nails, and teeth; sudoriferous and sebaceous glands. The dermis, derived from underlying mesenchyme, may become differentiated to form

cartilage, bone, fat, muscle, or other specialized tissue. Dermoids may occur as cysts or solid tumors. In the former, the dermis is on the outside and the epithelium lines a cavity, usually filled with inspissated oil secretion and hair. In the more common solid type, the epithelium is exposed to the surface of the body; a common site is astride the corneal margin. Solid dermoids are more common than the cystic variety about the orbit.

True teratomas must contain tissue derived from all three germ layers. These are exceedingly rare in the orbit and are usually malignant. The identification of tissue derived from the entoderm is sometimes difficult, and some pathologists rely on the complexity and variety of tissue in making a diagnosis of teratoma. The finding of tissue consisting of cavities lined by pure mucous epithelium with an arrangement characteristic of gut is considered diagnostic of endodermal origin. The dermoid variety of tumor is often referred to in the literature as teratoma, teratoid tumor, mixed tumor, and epibulbar tumor. A perusal of the literature for the past 10 years failed to disclose a single case of pure teratoma that is composed of tissue derived from three germ layers.

The most common locations of dermoids and teratoma are the ovaries, testes, and sacral regions, but they have been reported in nearly every part of the body. An analysis of dermoid cysts seen at the Mayo Clinic from 1910 to 1935 showed that out of 1,495 cases, 45 percent occurred in the postanal region, 42 percent in the genitalia, 7 percent in the head and neck, and 6 percent elsewhere. Among the dermoids of the head and neck, half were in the orbital region, and of these 60 percent occurred in the outer third of the eyebrow. Half of these were noted at birth. Only 10 percent of the dermoids of the orbital region (six in 25 years) were within the orbit, usually in the upper outer quadrant of the right orbit.

Case report. Baby M. was born on December 11, 1946, with a very large mass in the left orbit causing marked proptosis. At birth the conjunctiva and cornea were normal, but within 24 hours the conjunctiva became increasingly chemotic, and the cornea showed beginning cloudiness and infiltration. This process continued in spite of moist-chamber dressings during the following two days before permission for operation was obtained. The cornea was well formed, and measured 9 mm. in diameter. The globe could be palpated through the mass, and seemed to be definitely flattened anteroposteriorly. Behind the globe a solid tumor mass filling the entire orbit could be palpated. The outline of the mass was smooth except inferiorly where several nodules were felt. Transillumination of the mass gave the same consistency as the cheek. The globe transilluminated clearly. A needle passed into the mass for diagnostic aspiration failed to demonstrate fluid. The eye was not fixed, but motion was restricted to random irregular very slow oscillations.

The iris of the right eye was normally blue, but that of the proptosed eye was dark brown. The pupil was miotic, but dilated well with atropine. Slitlamp examination showed persistence of a well-marked pupillary marginal vessel. X-ray films of the orbits showed distinct enlargement of the left orbit with intact bony walls.

Physical examination was negative for other developmental defects, and the right eye was normal. A clinical diagnosis of microphthalmos with cysts was made, and exenteration of the orbit was advised at once to avoid deep infection of the eye and orbit, which was considered inevitable because of exposure and edema. Operative permission was obtained on the third day.

Operation was performed under infiltration anesthesia with no objection from the patient except to the injections. Two-percent procaine with adrenalin was injected into the lids and along the orbital walls to the apex in minimal amounts, and the conjunctiva was anesthetized by pontocaine instilla-

tions. The conjunctiva was first separated at the limbus on the temporal side, and the globe and outer aspect of the mass were exposed to ascertain the relation of the mass to the eyeball, and determine whether the mass was resectable without sacrificing the eye. It soon became apparent that the optic nerve passed through and seemed an integral part of the mass, and that the extraocular muscles and Tenon's capsule were so attenuated that they were not recognizable. An incision into the exposed mass showed it to be composed of solid tissue with multiple cysts containing clear fluid. A line of cleavage between the mass and the periorbita was readily obtained, and the mass could be easily separated.

The entire orbit was filled with tumor which extended to the orbital fissures and optic foramen. When the eye and mass were removed, a plastic implant was placed in the apex of the orbit, and the conjunctiva closed over it. A conformer was inserted in the conjunctival sac. When healing was completed and contraction of the cul-de-sac had stabilized, the conformer was replaced by an acrylic prosthesis made from a casting of the cavity. This has been worn continuously since then.

Measurement of the excised specimen showed the globe to be 18 by 19 mm. at the equator, and 15 mm. in the antero-posterior axis. The retrobulbar mass was roughly 5 by 4 cm., and contained multiple cysts on the surface.

Convalescence was uneventful, and the baby is developing normally with no evidence of recurrence to date.

Pathologic report. The microscopic sections of the excised specimen were examined by Dr. Jonas S. Friedenwald, Wilmer Ophthalmological Institute of The Johns Hopkins Hospital. His diagnosis was: Teratoma of orbit, microphthalmos, exposure keratitis, and hypopyon ulcer of the cornea.

The globe is quite small. The cornea is infiltrated and scarred. The anterior chamber is filled with polymorphs, many of which are seen in the iris stroma, but there is an abscess in the ciliary body. There are many retinal and subretinal hemorrhages, and a few tiny choroidal hemorrhages. The optic nerve shows partial atrophy.

The tumor is a large cystic mass containing fat, bone, cartilage, and many cysts lined with epithelium of varying forms. The epithelial forms include squamous epithelium with many hair follicles and sebaceous and sudoriferous glands, ciliated, columnar, and cuboidal mucous membrane with a papillary structure and arrangement characteristic of intestine. There are also small scattered glands of the racemose type resembling salivary or lacrimal gland.

The matrix of the tumor is young connective tissue. Other tissues that are embedded in this matrix are lymphoid follicles with germinal centers and nerve tissue including large ganglion cells.

Zentmayer Award

The third Zentmayer Award was presented to William M. Hart, Ph.D., for his paper "Hydration Properties of Excised Cornea and Factors Responsible for Transparency." This paper was presented at the October, 1946, meeting. See the JOURNAL, **30**: 1022 (Aug.) 1947.

Fusional vergence

DR. EDWIN FORBES TAIT (by invitation) presented a paper on "Studies in Fusion: Fusional Vergence," an abstract of which follows.

The fusional process in vision is a twofold entity. It is, first, concerned with sensory perception, which is that which should properly be designated as "fusion," and, second, the varying of the position of the visual axes of the eyes in order to retain single binocular vision, which should be considered as "fusional vergence."

Fusional vergence may be defined as the modification produced by the fusional process in the distribution of tonic reciprocal

innervation to the extraocular muscles, in order to preserve or to gain single binocular vision.

The author reports on 500 subjects, who were selected as normal individuals in view of the fact that they possessed clear, comfortable, and efficient single binocular vision and were wearing suitable glasses, if needed.

Prism convergence break and recombination tests, and prism divergence break and recombination tests were carried out with extreme care under certain standard conditions. Results were recorded with suitable allowance for the experimental variations and the patient's reaction time. The data show that in a group of 500 subjects, as prism convergence is increased, more persons will fail to maintain fusion. At 26-28$^{\Delta}$ only 10 percent can still maintain fusion but of these few, some can overcome as much as 38-40$^{\Delta}$. The midpoint of the range is about 18-20$^{\Delta}$.

With prism divergence, half of the subjects cannot maintain fusion with as much as 12-14$^{\Delta}$, although 10 percent can go as far as 18-20$^{\Delta}$, and some can go as far as 22-24$^{\Delta}$.

After the break, and the consequent diplopia, the prism power is reduced until eventually fusion is regained. With prism convergence, over 10 percent of the patients will regain fusion when 10-12$^{\Delta}$ remain, and 100 percent have regained fusion at 2-4$^{\Delta}$.

With prism divergence, the extramacular fusion area is apparently smaller, as only 20 percent have regained fusion at 6-8$^{\Delta}$, 50 percent at 4-6$^{\Delta}$, and the remaining 30 percent at 2-4$^{\Delta}$.

The data suggests that the response of the extraocular muscles to gradually increased prism power-base-out or base-in is dependent primarily upon the stimulation of receptors which immediately encircle the macular area. Reversion to fusion, however, once diplopia has been established, is dependent upon the sensitivity of more peripheral receptors than the perimacular ones, and the area in which these are found is considered as the extramacular fusion area.

On the basis of these studies, we may consider perimacular and extramacular receptors, and the ocular movements which result from their excitation, as the essential parts of the stimulus-response mechanism which is charged with the maintenance of single binocular vision.

Using the results of the reversion to fusion tests, it is possible to plot the linear dimensions of the extramacular fusion area upon each retina under given conditions of fixation and stimulation.

In general, it was suggested that the function of the perimacular fusional receptors, those immediately surrounding each macula, is to retain single binocular vision, once it is established, while the function of the extramacular fusional receptors, further in the periphery, is to aid in obtaining single binocular vision.

The use-amplitude fraction in fusional vergence is described and defined as the amount of fusional vergence constantly in use (in order to correct the faulty position of the visual axes for the point of fixation), over the amplitude of fusional vergence available in the same direction. In esophoria, relative to fixation at 6 meters, for example, a patient has a constant repeated stimulation of his nasal perimacular receptors of either or both maculas. If he has an adequate amplitude of fusional convergence, which means a sufficient number of perimacular receptors available, his esophoria may be compensated for without difficulty.

The use-amplitude fraction may be used practically in orthoptic problems to determine the probability of comfort or discomfort in binocular vision, and also to indicate the extent to which the fusional vergence amplitude values will have to be developed in order to compensate for heterophoria.

Discussion. Dr. Robert H. Peckham: Dr. Tait's paper is of perhaps unrecognized, but really quite tremendous, theoretical importance.

The function of binocular fixation in maintaining singleness of visual perception

with two stimuli is a matter of clinical importance, because of the asthenopia resulting from interruptions of that function. This function is also of considerable theoretical importance in explaining the phenomena of binocular vision. The oldest theoretical explanation is that of exactly corresponding retinal points. This theory was modified by Panum, who proposed that a point and an area are involved; that is, that an area in one eye is associated with a point in the other.

A paper which I had the privilege to read to this society, in 1934, summarized experimental evidence that binocular vision could occur with noncorresponding points, and that noncorrespondence could be quite great without loss of stereoscopic vision, or without loss of binocular fusion.

Now Dr. Tait has offered experimental evidence concerning the mechanism for the return to binocular fixation, after breaking binocular fusion with prism convergence or prism divergence. He has offered an explanation of this return which does not require the stimulus of exactly corresponding points, because, if the stimulus of corresponding points were required for the return to binocular fixation, it would be necessary for the prisms to be reduced completely to zero value before the two maculas could be stimulated with the same image, and binocular vision result. He has suggested a function which would permit the binocular fixation to return without the retinal images being moved, by the prism power, to both maculas, or to exactly corresponding points. Unfortunately, he has not been able to demonstrate the actual eye movements involved, so that we are not in a position to trace fully the course of events in terms of perception and movement, and thus infer the stimulus and response mechanisms involved throughout the prism divergence and convergence. Nor did the measurments I made in 1934 carry the problem to completion, because I did not allow my subjects to break in their fusion.

However, it now becomes possible for us to anticipate a method of attack on the problems of stimulus-response mechanisms in binocular vision, since Dr. Tait has shown that the fusional areas near the maculas are of statistical nature; that is, with increasing distances from the maculas there are decreasing probabilities of stimulus for return to binocular fixation. It may be possible with more experimental work, perhaps with objective eye-movement studies correlated with Dr. Tait's observations, to explain the entire binocular function in terms of the fusion of corresponding and noncorresponding points, and the probabilities of the stimulus values of such points for the maintenance of binocular fixation.

Dr. Francis Heed Adler: I am particularly interested in this work, which merits consideration, because the author has been carrying out in experiments on normal subjects what we hope sometime to be able to do in cases of strabismus. The first part of his presentation deals with the reflex fusional movements of the eyes, which are independent of the will and brought about, as the author states, reflexly by the potency of the receptors in the region of the fovea. He has succeeded in mapping out the area of that reflex innervation. On top of that is a voluntary innervation. It is this innervation which the patient brings into play when he is given prism exercises. Although both of these mechanisms work hand in hand and simultaneously, the reflex mechanism is the one which is the more important, and which is the true measure of fusion. Ordinarily, fusion is measured subjectively. This provides a method of measuring fusion objectively. We should be able to determine an individual's fusional capacities by the reflex movement of his eyes, if we can eliminate the voluntary mechanism. Such studies would afford us a quantitative measure of the fusional movements which keep the eyes in alignment and would be, therefore, an objective measure of fusion, independent of any subjective phenomena.

We are hoping in the very near future to be able to measure the fusional capacity of children with squint. We wish to know whether the objective measurements of these children correspond to their subjective responses to fusional stimuli. Further than this, we wish to know whether orthoptic exercises can change these objective values as well as the subjective values.

I feel that Dr. Tait has made a valuable contribution to our knowledge.

Dr. Edwin Forbes Tait: I should like to thank Dr. Peckham and Dr. Adler for their helpful discussions.

Regarding the question which Dr. Adler asked relative to changes in the basic tonic convergence after orthoptic procedures, in my experience there has been, in most cases, very little change in the lateral heterophorias after such exercises. However, it seems that when the appropriate fusional convergence amplitude is increased by exercise, which can easily be done in the convergence insufficiency cases, the patient usually is more comfortable, probably because of increased ability to compensate for his heterophoria.

Mass survey for detection of glaucoma

Dr. Carroll R. Mullen gave a preliminary report concerning activities and results associated with a mass study for the presence of glaucoma being conducted by the Philadelphia Committee for Prevention of Blindness under its executive director, Miss Evelyn Carpenter, with the guidance and advice of its medical advisory committee. The actual examinations were conducted by Dr. Victor I. Seidel, Dr. Harry A. Felice, and Dr. Solomon S. Brav.

A total of 2,455 individuals were studied and 33 cases of chronic simple glaucoma have been diagnosed, together with one case of secondary glaucoma. All of those examined in this survey were volunteers. The largest group examined was made up of the employees of several department stores, totaling 1,788. Employees of home offices of several insurance companies totaled 508, and another group of 159 from one industry was observed.

Difficulty in inducing employers to allow their workers to take time and set aside space for these examinations had been anticipated, but this did not occur. Actually, the employees were solicited to volunteer for examination.

In the department store group, 41 were below the age of 35 years, 508 were between the ages of 35 and 45 years, 705 were between 45 and 55 years, 435 between 55 and 65 years, and 98 were over 65 years of age. Three ages were undetermined, probably falling in the last older age classification. In this group, a diagnosis of chronic simple glaucoma was made in 33 employees, and one worker had secondary glaucoma. There were 13 men and 20 women; 1 woman, designated as having glaucoma, belonged in the undetermined age group; 2 men and 3 women were between 35 and 45 years of age; 3 men and 8 women were between 45 and 55 years; while 6 men and 8 women were between 55 and 65 years; 2 men were more than 65 years of age.

Of the insurance company office workers examined, 4 were under the age of 35 years; 194 were between 35 and 45; 177 were between the ages of 45 and 55; and 120 were between 55 and 65 years of age; while 13 were aged over 65 years. Glaucoma was diagnosed in two of these workers with a possible diagnosis in one other case. The two cases were men between the ages of 55 and 65 years, and the one probable case was a woman between the age of 35 and 45.

In the one industry in which a total of 159 employees volunteered for examination, the group included two under 35 years of age; 16 between the ages of 35 and 45; 61 between the ages of 45 and 55; 53 between the ages of 55 and 65; and 27 over the age of 65. In this group, one probable case of glaucoma (a 66-year-old man) was found. Two additional cases have now been diagnosed, and they are in the age group of 45 and 55 years.

The procedure for this study was to make an initial plea to workers to volunteer for examination. Visual acuity was first recorded, then an external examination was made by an eye physician. An ophthalmoscopic study through the undilated pupil was recorded. Intraocular-pressure examinations were made using a Schiøtz tonometer. In all cases in which tension was recorded at 25 mm. Hg or higher the volunteer was reexamined. If his record still remained higher than 25 mm. Hg, the individual was referred to an eye clinic or to his own private ophthalmologist for visual-field studies, provocative tests for glaucoma, further tension recordings, and treatment.

It is probable that there are people working in the above establishments who have glaucoma, know that they have it, and are already under treatment, and, not wishing to discuss the fact with their employers, did not volunteer for examination. It is of interest to note that none of the 33 cases of chronic simple glaucoma had any knowledge of the condition of their eyes. Only five of these employees had every consulted an ophthalmologist for any previous type of eye care.

This mass survey for the presence of glaucoma is a progressive step in the endeavor of the Philadelphia Committee for Prevention of Blindness to locate diagnosed cases of glaucoma, to follow them up, and to aid the ophthalmologist in preventing total loss of vision.

Until February, 1940, there was no organized follow-up service for glaucoma patients in eye clinics in Philadelphia. In his presentation Dr. Mullen reviewed the formation of this service under the Philadelphia Committee for the Prevention of Blindness. He likewise reviewed the number of glaucoma cases that had been observed and followed in the Wills Hospital in conjunction with this survey.

This report outlines the endeavor to determine the number of individuals with undiagnosed glaucoma who are not aware of their condition and have not had medical attention. With more than 2,400 patients studied, the over-all total is 1.3 percent, which is somewhat less than previous figures estimated for the general population. Gathering of this information may be of great service to all workers in the ophthalmic field who are especially interested in the study of glaucoma.

George F. J. Kelly,
Clerk.

Historical Miniature

Although Fabricius ab Aquapendente recognized the true position of the lens he looked upon it as the organ of vision. The surgeons were expected to be very ignorant of optics. Kepler, the great astronomer, thought that an error in optics made by Felix Platter, a distinguished student of the physiology of vision, was excusable because he was a physician.

Hirschberg, *Graefe-Saemisch Handbuch.*

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THE OXFORD OPHTHALMOLOGICAL CONGRESS

The 34th annual meeting of the Oxford Ophthalmological Congress was held on July 8th, 9th, and 10th at the School of Geography in Oxford. Members were housed at Hertford College nearby. About 100 ophthalmologists attended.

The meeting was called to order by the Master, Mr. F. A. Williamson-Noble, who then gave the address of welcome.

The morning of the first day was devoted to a discussion on "The Use and Abuse of Topical Ocular Therapy." Mr. F. Ridley gave an excellent talk on the structure and function of the tear film and its surface tension and absorption properties. He spoke of the biochemistry of the tears, on which he is a recognized authority, and how their bacteriocidal properties are related to their interaction with applied remedies and to the physical structure of ointments. He emphasized that the lysozyme content of tears is definitely diminished in local epiphora and that atropine affects the lacrimal gland by decreasing epiphora and relatively increasing lysozyme. Hence atropine might well be used in certain stubborn cases of conjunctivitis.

Dr. F. E. Preston continued the discussion with a historical resume of local therapeutic agents and made a plea for more uniformity in drug terminology.

Further discussion was contributed by Dr. J. M. Robson of Guys Hospital, whose contributions to the literature of chemical warfare are so well known. He gave a thorough review of local therapeutic methods. In discussing the use of detergents, he pointed out that increased corneal permeability was not due to their surface-tension reducing effect alone, since, if one removes the corneal epithelium of a rabbit, the addition of a detergent does not increase permeability of drugs. With regard to intravitreal injection he felt that streptomycin was toxic to the retina, but that pure crystalline penicillin was not.

In the afternoon Dr. J. J. Healy presented the case histories of a series of unusual ocular injuries. Dr. Grant Peterkin gave a talk on "Dermatological Conditions Affecting the Ocular Adnexa," and Mr. Dickson Wright spoke on "The Approach to Orbital Tumors." Mr. Wright's talk was outstanding for its clarity of expression, and the excellence of the moving-picture film shown. He freely removes the orbital rim for better exposure.

Mr. Frank Law presented a report on a case of retinoblastoma at the second morning session. The highlight of the meeting occurred when Sir Stewart Duke-Elder gave the Doyne Memorial Lecture on "The Blood-Aqueous Barrier." This consisted in an outline of the development of our conceptions of the intraocular fluid and a comparison of earlier techniques with more modern methods, particularly those employing tracer elements.

The author stated that results obtained by these newer techniques have shown that his original theory, that the aqueous is a simple dialysate, is wrong, and that the process is a far more complicated one involving a combination of dialysis and secretion.

The afternoon was devoted to a discussion on "The Operative Treatment of Chronic Glaucoma," by Mr. F. A. Williamson-Noble and Mr. Maurice Whiting. Many others also participated. The consensus of opinion was that the trephining operation gave the best results, but the iris-inclusion operation had its advocates. What impressed a visitor was the apparent disregard of the anterior-chamber depth and the condition of the iris angle in contemplating surgery. This was never mentioned.

On the final day there was a morning session only. Prof. A. Lowenstein gave a beautifully illustrated talk on "Some Facts and Aspects of the Anterior Drainage System in the Human Eye." Mr. J. Minton spoke on "Occupational Eye Diseases of the Lens and Retina." Dr. Gunnar von Bahr of Sweden discoursed ably on the "Measurements of the Effect of Solutions of Different Osmotic Pressure on the Thickness of the Living Cornea." Dr. Winnifred Fish gave a short paper on "Hereditary Mesodermal Atrophy," reporting four cases, and Dr. Margaret Dobson spoke on "Dynamic Retinoscopy."

The social aspects of the congress were, as usual, delightful. Tea was served in Hertford College in the late afternoons following the scientific sessions and was enjoyed amid the charm of old-world surroundings. The annual dinner took place in the refectory of the college on the night of July 8th.

The Oxford Congress, founded by Doyne in 1914, continues to hold a secure place in British ophthalmology.

Edwin B. Dunphy.

READING EFFICIENCY

A study of the reading skill of adults shows that the ocular movements account for but 10 percent of the reading time—the fixation pauses for 90 percent. As reading skill progresses from the grades to college, the fixation pause decreases from two-thirds second to about one-fifth second and the regressive movements decrease from an

average of five per line to one-tenth as much. Retinal perception requires less than one-tenth second, although the fixation pause is at least double this period. The convergence is not fixed but relaxes slightly with each fixation pause so that between the beginning and end of each line there is a rhythmic lessening of convergence of about one-half prism diopter. Peripheral vision provides unconscious clues and so prepares for the next fixation pause. Hence a narrow span of the visual field retards the speed of the reading process.

In both children and adults the rate of reading is not much affected by the size of type, between 6 point and 36 point but, for the most efficient reading, size of type, length of line, and interlinear space must be correlated. As there is a certain correspondence between area and reading speed, size of type and interlinear space, may, to some extent, be substituted for each other. An excessively short line (37 mm.) does not permit maximum use of peripheral vision, while with excessive length of line (180 mm.) the long return movement is accompanied by increased regressions at the beginning of successive lines. Between such extremes, size of type and length of line can be balanced for maximum effectiveness. In a test on second graders with a 61.5-mm. line, 3-point leading, the 12-point type placed first in speed, 14-point was second, and 18-point a poor third. For adult reading, 10-point type on an 80 mm. line with 2-point leading is considered optimal.

The most readable type is that which is fairly simple in design. Paradoxically, features that increase clarity for distance may, nevertheless, slacken the reading pace. Words in capitals when compared to lower case are read at a greater distance, but for speed of reading the order is definitely reversed. In distance tests, the least visible type form was Scotch Roman, a lightface type, while the most visible was American Typewriter; yet, the former led the latter in reading speed by 5 percent.

As checked by the rate of reading, black print on a white or cream background is superior to any other combination. The quality and texture of the paper is of relatively minor import.

The best quality of illumination for reading is daylight from the north sky. In the most favorable light distribution, the brightness of the central field and that of its surroundings are approximately equal. For exceedingly fine work, the normal eye does not require more than 20 foot-candles, but for ordinary reading 8 to 10 foot-candles are considered adequate. A study lamp with a 60-watt Mazda bulb provides by itself about 7 foot-candles on the reading surface.

The study of eye movements by photography of the corneal reflections has several drawbacks. The procedure necessitates the elimination of head movement, the presence of light in the visual field, and the restriction of the reading span to less than 20 degrees. But the electrical method about to be described allows any amount of continuous and unrestrained reading under any desired conditions.

When the reader has small electrodes affixed to his outer canthi and these electrodes are connected with an equipment like that used in electrocardiography and electroencephalography, a tracing results—the electro-oculogram—that is quite similar to the familiar photographic record. As the eye moves, the electrodes are affected reversely by the intrinsic corneoretinal potential, since the electrode on the side of the approaching cornea receives more positive units and that on the side toward which the retina advances, more negative units. The voltage change follows closely the extent of the ocular excursion. When the apparatus is equipped with an ink-writing oscillograph it can furnish an automatic record of continuous reading of many hours' duration, and with extra leads the heart beat, brain waves, and the blinking reflex can be simultaneously registered.

Using such a complete set up, the problem of fatigue in reading was exhaustively studied by the educational psychologists,

Leonard Carmichael and Walter F. Dearborn. Forty high-school and college students read for six hours continuously, first a historical novel and then a formal treatise on economics. Comprehension was checked by a multiple choice questionnaire interspersed at about every 25 pages. Conditions were optimal—both books were in the same approved format, and the well-distributed illumination provided 16 foot-candles on the reading surface.

Statistical analysis of the six-hour records revealed no significant change in reading behavior, nor any distinction in performance between the type of material, between the high-school or college group, between books and microfilm, or between those wearing and those not wearing glasses.

In a previous study by Hoffman, 30 subjects who read for four hours continuously without comprehension checks displayed increasing reading deterioration after the first hour, as was shown by increased blinking, decreased reading rate, word skipping, and wandering attention. Evidently the comprehension tests, by inspiring motivation, made the striking difference in the objective results. The first evidence of fatigue in reading is an altered attitude toward the task, not in any breakdown of the neuromuscular visual mechanism. Motivation is the all-important variable and, when present, reading can be maintained for hours at a high level of efficiency. The action of the ocular musculature, like that of the heart, is intermittent and so permits adequate recuperation. James E. Lebensohn.

OBITUARY

ELIAS SELINGER

(1898-1947)

Elias Selinger, son of Joseph Selinger and Rosa Feuereisen Selinger, was born in Moravska-Ostrava, Czechoslovakia, August 23, 1898, and came to the United States at the age of 15 years. He received the degree of Doctor of Medicine from Northwestern University in 1924 and decided at once to specialize in ophthalmology. After internship and residency at Cook County Hospital, he furthered his training in Vienna in 1926, and again in Paris and Vienna during 1932-1933. He became clinical assistant in the department of ophthalmology of Northwestern University Medical School in 1926. He left that department with the rank of instructor in 1929 to become associated with the eye department of the Rush Medical

Elias Selinger

College of the University of Chicago. When he resigned from that institution in 1941, he held the rank of assistant professor. Only a few months before his death, Dr. Selinger was appointed professor and chairman of the department of ophthalmology at the reorganized Chicago Medical School.

Dr. Selinger was certified by the American Board of Ophthalmology in 1931. He was attending ophthalmologist at Mount Sinai, Cook County, and Michael Reese Hospitals, and was a member of the American Medical Association, the Chicago Ophthalmological Society, the American Academy of

Ophthalmology and Otolaryngology, the Pan-American Ophthalmological Society, and the American Society for the Advancement of Science.

Among his numerous contributions to ophthalmology, the most original was the introduction of the topical application of quinine in treatment of trachoma and interstitial keratitis; his *Office Treatment of the Eye* was widely acclaimed by ophthalmologists throughout the country.

Elias Selinger was an outstanding surgeon. For his associates, it was a source of continuous amazement to see him approach each individual case on its own merits instead of following a standardized procedure. This and his meticulous deftness of technique, as well as his painstaking postoperative care of each patient, accounted for his superior surgical results.

As a consultant he always respected the opinion of the referring surgeon but seldom failed to make constructive suggestions. He had a rare gift as an organizer. Not given to compromises, he was never satisfied with half measure in whatever he undertook, and succeeded in inspiring his associates with the same spirit. He was always interested in the problems of the younger men in his specialty and ready not only to advise but to take active steps to assist them on the road to the practice of ophthalmology.

His activities in various committees allowed him little time for relaxation, and that was spent with his family.

There was little warning to his immediate family, and it came as a complete shock to his numerous friends, colleagues, and patients when a coronary thrombosis caused his untimely death in El Paso, Texas, on December 21, 1947. In his death, ophthalmology loses one of its most promising members, just at the summit of his career.

He is survived by his wife, Mildred Williamson Selinger, and a daughter, Suzan Mae.

Stefan Van Wien.

CORRESPONDENCE

Near point of accommodation

Editor,
American Journal of Ophthalmology:

In their highly scientific paper on "Effects of Practice and the Consistency of Repeated Measurements of Accommodation and Vergeance," by Brozek, Simonson, *et al.* (Am. J. Ophth., **31**: 191 (Feb.) 1948), the authors say: "The true accommodation near point should be determined as the distance from the anterior focus of the eye, located about 14 mm. in front of the cornea, to the point of blurring. The correction is essential when the power of accommodation is expressed in terms of diopters. . . ."

Now the point from which the near point of accommodation should be measured has not yet been completely standardized. But most authorities figure that for determination of true accommodative power the near point should be measured from the first principal point of the eye. It may be sufficiently accurate (to within less than 2 mm.) to measure the distance from the cornea, but measurement from the anterior principal focus of the eye seems less desirable.

The increase of refractive power, which is termed accommodation, takes place at the principal planes of the eye. The power of all refractive systems is determined by the principal focal length; that is, the distance measured from the corresponding principal point. The refractive power of the static eye and the far point of the static eye are thus expressed and there is no reason not to use the same reference points for the power of the dynamic (accommodated) eye.

It is true that in calculations for conjugate foci, and the near point is the conjugate focus to the retina of the accommodated eye, several fixed points of reference can be used, including the principal foci. It is also true that where lenses are worn it is convenient to make measurements from the plane of the lenses which are practically in the first principal focal plane of

the eye. But these considerations are not sufficient to change the generally accepted reference points which are the principal points. Where measurements are made from the plane of the correcting lens, 15 mm. (in round numbers) is added to get the distance from the principal point.

Another consideration is that, while measuring the near point, from F_1 of the eye is convenient for figuring the power of the lens which replaces accommodation; when used for measuring accommodative power it does not disclose the intrinsic difference in accommodative activity as between the natural emmetrope, the corrected hyperope, and the corrected myope. For example, a near point, say, of 10 cm. measured from F_1 of the eye of the natural emmetrope, the 4.0D. corrected hyperope and the 4.0D. corrected myope, would give each one 10 diopters of accommodation.

Actually, this near point shows that the natural emmetrope can accommodate—that is, increase the power of his eye by 8.7 diopters; the 4.0D. corrected hyperope can accommodate 10.09 diopters, and the corrected myope can accommodate only 7.66 diopters.

An accurate determination of accommodative power in all cases is best determined by measuring the near point from the principal plane of the eye, which measurement gives the number of accommodative units the patient has. The value in diopters is then found from the dioptral value of the accommodative unit (Pascal: Tr. 2nd Pan-American Congress of Ophthalmology, **3**:53-77; Eye, Ear, Nose & Throat Monthly, **25**:354-362 (July 1946).

Whatever method is used, the discrepancies may not be large, but in the interests of scientific accuracy they are worth noting.

(Signed) Joseph I. Pascal,
New York.

BOOK REVIEWS

DISEASES OF THE EYE. By Sir John Herbert Parsons and Sir Stewart Duke-Elder. New York, Macmillan Company, 11th edition, 1948. 732 pages, 368 figures, 21 plates, and index. Price, $7.00.

Parsons' *Diseases of the Eye* is a perennial favorite with ophthalmologists and general physicians and their teachers, both in this country and abroad. It is a little more elaborate than the textbooks of May and of Gifford, since it is written more for the general practitioner than for the medical student. Because of this, however, it is of particular value to the physician who wishes to have in his reference library a book on ophthalmology that covers the unusual conditions, as well as those subjects more commonly encountered.

Since the 10th edition that appeared in 1942 and was reprinted in 1944, many advances have been made in the practice of ophthalmology, especially those produced by chemotherapy, new concepts of the etiology of choroiditis, and many others. The authors have taken great care to incorporate these advances in the new text and, in weeding out the old beliefs, have retained what has been shown by the passage of time to be useful.

It is pleasing to see, yoked with the notable name of Parsons, that of Duke-Elder. These two eminent and authoritative ophthalmologists, each a top-flight author in his own right, together insure that the information contained in their book is accurate and unquestioned. It cannot be recommended too highly.

Derrick Vail.

HANDBOOK OF OPHTHALMOLOGY. By Everett L. Goar. St. Louis, C. V. Mosby Company, 1948. 166 pages, 45 text illustrations, and 7 color plates. Price, $5.50.

There have been several attempts during the past few years to present the field of

ophthalmology in outline form for the benefit of undergraduate medical students. This trend recognizes the overburdened medical curriculum and the fact that the limitation of time and the somewhat meager interest of most students in such a specialized subject preclude adequate perusal of the more extensive texts. These handbooks, therefore, have a very definite place in undergraduate teaching and, perhaps, may be of help to the general practitioner who desires a broad perspective of this branch of medicine; for the graduate student and practicing ophthalmologist they are, of course, too incomplete to be of value.

The present *Handbook of Ophthalmology* was first written as a series of lectures for medical students at Baylor University and presents in an abbreviated and concise form the essential facts about the eye with which the student should be familiar. Dr. Goar has done his editing judiciously, and little fault can be found either with the subject matter included or omitted or with the manner of presentation. The book is well printed on a good grade of paper and contains numerous and fairly adequate illustrations.

Somewhat unusual in a work of this limited scope is the introductory historical chapter, and the author is to be congratulated for including this cultural background. Separate chapters deal with anatomy, embryology, and physiology. A chapter on "Methods of Examination" describes not only routine but also the more refined instruments of diagnostic value, and a separate chapter deals with the ophthalmoscope and normal fundus. Twelve pages are devoted to refractive errors and the principle of their correction. External diseases are discussed in orderly fashion, and the common fundus lesions are described and illustrated. Subsequent chapters deal with glaucoma, intraocular tumors, strabismus, and the eye in general disease. The final chapter discusses eye injuries and first aid and ocular therapeutics, including a few helpful prescriptions.

This *Handbook of Ophthalmology* appears most useful for the purpose for which it is intended and deserves wide use in medical schools. William A. Mann.

THE ANATOMY OF THE EYE AND ORBIT. By Eugene Wolff. Philadelphia, The Blakiston Company, 3rd edition, 1948. 440 pages, 323 illustrations including 24 in color, bibliographies, and index. Price, not listed.

Wolff's *Anatomy of the Eye* is too well known to require much discussion. The handsome third edition, beautifully printed and illustrated, is superior in many ways to its predecessor. The chief changes in the text are "in the descriptions of the ciliary muscle, the substantia propria of the cornea, the vitreous, the zonule of Zinn, the distribution of the lacrimal fluid, the mucocutaneous junction at the lid margin, the precorneal film, the retinal capillaries, and the central connections of the visual apparatus" in the light of the latest information.

It is certain that every student and practitioner of ophthalmology will require this authoritative book in his daily work for study and reference. Derrick Vail.

THE BLIND PRESCHOOL CHILD. Edited by Berthold Lowenfeld, Ph.D. New York, American Foundation for the Blind, Inc., 1948. 148 pages. Price, $2.00.

The ophthalmologist having easy access to the social services discussed in this collection of papers presented at the National Conference on the Blind Preschool Child, March 13 to 15, 1947, will have no urgent need for the book, although he will find it stimulating and interesting reading.

Ophthalmologists in more isolated communities, however, to whom these services are not available, can glean many constructive suggestions from the pages of this slim volume—suggestions that will give them a

more understanding and sympathetic insight into the problems faced by the parents of blind babies.

The contents are arranged according to three phases of the problem of the blind preschool child—the social work, educational, and medical aspects. There is also a summary of the conference written by Berthold Lowenfeld and a message from Helen Keller.

Under the division, "Social Work Aspects," authorities in this field discuss such pertinent subjects as: "The Influence of Institutionalization on the Young Child," "Parental Attitudes," "Individual Case Work with Parents," and "Group Work with Parents." Legislative provisions for the blind preschool child, social workers' responsibilities, and reports from four states—Illinois, New Jersey, New York, and Wisconsin—in regard to the number of cases, cause and degree of blindness, and age groups complete this section of the book.

"Educational Aspects" include thoughtful studies on "The Emotional and Social Development of the Young Child," "Training Problems and Techniques," "Measuring the Mental Development of Blind Preschool Children," and "Facilities for the Education of Blind Preschool Children."

Under "Medical Aspects," Dr. Arnold Gesell discusses "Development and Guidance of the Blind Infant"; Dr. Brittain F. Payne, "Early Diagnosis of Visual Defects"; Dr. Robert R. Chace, "The Hereditary Aspects of Blindness"; and Dr. Merrill J. King, "Retrolental Fibroplasia."

Negative attitudes never solve any problems. Because this book offers dynamic counsel, the ophthalmologist can recommend it without hesitancy to the parents of the blind preschool child.

Katherine Chalkley.

THE SKULL, SINUSES, AND MASTOIDS. A HANDBOOK OF ROENTGEN DIAGNOSIS. By Barton R. Young, M.D. Chicago, The Year Book Publishers, Inc., 1948. 148 plates, bibliography, index. Price, $6.50.

There has long existed a need for this book. Only the exceptional ophthalmologist is competent to make a roentgen diagnosis of the area within his field. Every day in an active practice, this problem is met, and the ophthalmologist has had to be dependent upon the interpretation of the X-ray findings reported by the X-ray department to help him.

Superbly printed on excellent paper and beautifully illustrated, the volume is a most lucid exposition of its title. Unfortunately, the subject of foreign bodies in the orbit or within the globe is not discussed. Ophthalmologists would like to see a chapter devoted to this matter with a discussion and evaluation of the many methods of localization. Perhaps, in the next edition, the author can be persuaded to add this information.

As a compensation for this lack, however, the reader will gain a better understanding of the X-ray pictures of diseases and conditions affecting the orbit and the sinuses than perhaps he has hitherto enjoyed. It is recommended reading.

Derrick Vail.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

6

OCULAR MOTILITY

Caballero del Castillo, D. **Bilateral, symmetrical, partial paralysis of the oculomotor.** Arch. Soc. oftal. hispano-am. **8**:396-402.

A case of bilateral paralysis of the superior, internal and inferior rectus muscles of 11 years' standing, due to lues, is reported in a woman, 76 years of age. There was also paresis of the elevators of the upper lid. The pupils were miotic, with Argyll Robertson reactions. The anatomy and vascular supply of the oculomotor nuclei are reviewed in detail, and it is concluded that the lesion was produced by an endarteritis of the basilar artery. The intraocular muscles were spared because the vascular supply of their nuclei comes from the posterior cerebral arteries. The sparing of the inferior oblique muscles makes questionable the accuracy of Bernheimer's scheme for the nuclei of the oculomotor nerves in which the nucleus for the inferior oblique is placed in front of the nucleus for the inferior rectus muscle. This lesion suggests that the nucleus of the inferior oblique is situated most posteriorly. (3 figures.) Ray K. Daily.

Danis, P. **Congenital muscular anomalies—the syndrome of Stilling-Türk-Duane.** Ann. d'ocul. **181**:148-181, March, 1948.

In this outstanding contribution, the 175 references employed illustrate the author's thoroughness and understanding. Primary global retraction of orbital origin characterizes the unilateral form of this syndrome. The cardinal symptoms are diminished abduction, global retraction on adduction, and decrease of the palpebral opening. Less frequent are ocular protrusion and palpebral enlargement on abduction, vertical deviations on adduction with or without convergence weakness. The secondary angle of strabismus is greater than the primary, which is characteristic of orbital lesions. Spontaneous diplopia is absent. The left eye is much more frequently affected, and the disturbance is more common in women. The external rectus is aplastic, frequently only a band of fibrous tissue, and the internal rectus insertion is frequently too far posterior. If the external rectus subnormality is dominant, divergent strabismus follows; if the internal rectus is dominant, convergent strabismus results; if both are involved, the strabismus may be external or internal.

With passive motion made with a fixation forceps adduction without retraction suggests abnormal insertion of the internal rectus, adduction with retraction suggests primary external rectus involvement, and abduction with difficulty, internal rectus inextensibility. Global retraction is essentially due to displacement of the ocular center of rotation backwards and laterally, with resulting unequal ocular alignment. Because of the slightly oval shape of the globe combined with unequal traction, the eye is potentially forced backward during adduction and forward during abduction. Associated vertical imbalance indicates that the oblique muscles are involved. Palpebral involvement is a passive process.

In the bilateral form, males and females are equally affected; the manifestations are frequently not symmetrical and other constitutional subnormalities such as bilateral absence of the lacrimal glands and deformities of the extremities are often associated. Different forms of hereditary transmission are known to exist, the genealogical trees having been traced through three generations in several cases. The most frequent conditions associated especially with the bilateral form of the Türk syndrome are hypofunction of the facial and other cranial nerves, somatic subnormalities, and vertical ocular deviations.

Vertical involvements of primarily muscular origin are due to dysfunctions of convergence or to imbalance of the oculogyric mechanism. Congenital abduction palsy with global retraction and with vertical motor and other muscular weaknesses is one of the numerous groups of vertical and horizontal motor involvements possible.

In primary peripheral congenital abnormalities, abduction palsy may be associated with global retraction-protrusion, vertical dysfunction, and isolated palsies of individual muscles. Three basic etiologic factors must be evaluated singly and as a unit. These factors are constitution, environment, and time. Thus the more frequent left-sided occurrence of the monocular form is due to excessive pressure on the left side of the head or left orbit before or during birth, combined with constitutional or genetic tendencies, the exact nature of which is unknown. In one group the ocular involvement is but a variable part of the dysraphic syndrome. In primary mesoblastic subnormalities somatic malformations seldom exist. In epiblastic subnormalities diffuse malformations are frequently associated. Several illustrative cases are presented.

Chas. A. Bahn.

7

CONJUNCTIVA, CORNEA, SCLERA

Agnello, F. **Ocular mycoses in East Africa. Two voluminous epibulbar granulomas caused by fungi.** Boll. d'ocul. 27: 111-118, Feb., 1948.

In 1938 and 1940, the author observed in the eye hospital of Addis Ababa two patients with ascaris infection, who had unilateral indolent glossy hemispheric tumors of appreciable size and of red or whitish color. The masses were fixed on the sclera and did not involve the cornea. The tumors were removed in local anesthesia. Cultures could not be taken, but microscopically hyphae and spores were found. The size of the tumors may be explained by the virulence of the fungi and by climatic and enviromental factors.

K. W. Ascher.

Amsler, M., and Verrey, F. **The taking of the keratoplastic graft.** Arch. d'opht. 8:150-151, 1948.

The authors state that removal of the whole eye from the cadaver is an unecessary, mutilating procedure. They excise the two corneas at the limbus, leaving the pupils and irises intact. This is important

psychologically for the relatives of the deceased. The corneas are conserved in liquid paraffin in the refrigerator until the time of operation. Particular care is necessary not to damage in any way the zone of the grafts.

The grafts are obtained by trephining the posterior surfaces of the corneas first which makes for perfect section of the endothelium and Descemet's membrane. To facilitate this procedure the graft is placed in a depression made in a block of paraffin and the trephine used by pressure alone, without rotation, in order to avoid damaging the epithelium. The authors claim that by means of this technique the graft is adapted perfectly to the opening in the receptor eye and has received minimal trauma in manipulation.

Phillips Thygeson.

Busacca, A. **The lymphatic vessels of the human bulbar conjunctiva studied after vital staining with trypan-blue.** Arch. d'opht. **8**:10-32, 1948.

Busacca studied biomicroscopically the lymphatic vessels of the normal bulbar conjunctiva after subconjunctival injections of trypan-blue and states that the conclusions drawn from previous research must be modified radically. He found the lymphatic vessels in the zone of the end capillary loops at the limbus to be situated in general in a plane posterior to the blood vessels and to be larger than the vessels and arranged radially for the most part. In the palisade zone the lymph vessels were larger than the veins of the region and were arranged radially with few anastomoses. The lymph vessels of the limbus region were found to continue without interruption into a rich network of vessels of different calibres, many of which possessed valves. Some collector vessels were found to run parallel to the limbus. In the upper fornix certain vessels disappeared towards the orbit whereas in the lower fornix the collector vessels ran horizontally towards the external canthus where they disappeared. Busacca noted further that over the entire cornea there was an extremely fine network of lymphatics just beneath the epithelium. No lymphatic ganglia, even rudimentary ones, were found in the conjunctiva and there was no episcleral network.

The author concludes that the interpretation of many authors (Gallemaert, Koby, Rollin, Cuenod and Nataf, Ascher, and others) that the limbal palisades are perilimbic lymph vessels is erroneous.

Phillips Thygeson.

Landau, J. and Stern, H. J. **Flare-up of trachomatous pannus due to ariboflavinosis.** Am. J. Ophth. **31**:952-954, Aug., 1948. (1 figure.)

Much, V. **Bee venom in the treatment of herpetic keratitis and superficial punctate keratitis.** Ophthalmologica. **115**: 89-100, Feb., 1948.

Much reports definitely beneficial results with bee venom (injected intracutaneously) in cases of typical herpetic (dendritic) keratitis as well as in cases of an epidemic form of superficial punctate keratitis.

Peter C. Kronfeld.

Rapisarda, Dante. **Further considerations on the keratoconjunctival tuberculids.** Ann. di ottal. e clin. ocul. **73**:107-114, Feb., 1947.

The licheniform tuberculids (lichen scrofulosus) of the conjunctiva and cornea have been noted by Rapisarda as not uncommon in regions where the population has suffered from undernutrition, particularly from lack of vitamin A, and where the incidence of tuberculosis has increased.

The keratoconjunctival tuberculids (lichen scrofulosus and phlyctenular keratoconjunctivitis), especially when occurring in infancy, should be reckoned among the

ocular signs useful in the diagnosis of general diseases. They are as important as tuberculin tests and merit the attention of internists and particularly pediatricians.

Fascicular keratitis is becoming progressively rare, at least in Catania. This may indicate a modification in the nature and behavior of the tuberculids.

Rapisarda considers the keratoconjunctival tuberculids to be manifestations of an allergic state, occurring not only in infective (tuberculous) allergy, but also in various forms of noninfective allergy.

Harry K. Messenger.

Rosen, Emanuel. **Pterygium.** Brit. J. Ophth. **32**:300-304, May, 1948.

The author decries the inadequacies of the McReynolds transplantation technique for the treatment of pterygia and states that recurrence of the disease is the rule even in the hands of the experiencd. He describes his own technique which resulted in only one recurrence in twenty-five cases. The head of the pterygium is dissected from the cornea with a knife and the conjunctiva is separated from the limbus above and below the growth for 3 mm. The growth is separated along its edges and a double-armed silk suture is inserted into the head toward the sclera. The pterygium is then doubled back under itself so that episcleral tissue is approximated to episcleral tissue. The sutures are brought out through the center of the caruncle and tied over a rubber button. If the pterygium is very wide, it is sliced in its middle and folded under in two sections. The edges of the conjunctiva are approximated with interrupted sutures. The sutures are removed on the tenth day. (8 figures.) Morris Kaplan.

Saba, Vittorio. **Herpetic episcleritis.** Ann. di ottal. e clin. ocul. **73**:168-70, March, 1947.

Saba reports a typical herpetic keratitis occurring in an eye with a subsiding episcleritis, and concludes that the episcleritis is also a manifestation of the same virus. Harry K. Messenger.

Thygeson, Phillips. **Acute central (hypopyon) ulcers of the cornea.** California Med. **69**:18-21, July, 1948.

The author presents a series of 50 cases of acute central (hypopyon) ulcers of the cornea, of which 70 percent were caused by pneumococci. The role of solution-bottle contamination in the production of pyocyaneus ulcers is discussed. Proper systemic and topical use of the sulfonamide drugs arrests progress in all but very exceptional cases. The finding of sulfonamide-resistant strains of beta hemolytic streptococci and pneumococci has been rare. Orwyn H. Ellis.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Costi, C. **Treatment of iris prolapse by Blascovics cicatricectomy.** Arch. Soc. oftal. hispano-am. **8**:354-362, April, 1948.

The usual methods of dealing with iris prolapse are discussed, and the Blascovics cicatricectomy is described and illustrated in detail. Experience with the latter in four cases of prolapse convinced the author of its superiority over the usual methods of excision or cauterization. (6 figures.) Ray K. Daily.

Gardilčić, A. **A new iridodialysis operation.** Ophthalmologica **115**:141-155, March, 1948.

The ciliary border of the dialyzed iris is "incarcerated" in a slightly scleral keratome incision and fastened there by means of corneo-iridoscleral sutures of the de Mendoza type. Two successfully operated cases are reported.

Peter C. Kronfeld.

Orzalesi, Francesco. **The pathogenesis of serous detachment of the choroid.** Ann. di ottal. e clin. ocul. **73**:129-167, March, 1947.

The various pathogenetic theories of detachment of the choroid are discussed in detail. The determining factor in all cases is held to be the sudden or rapid reduction of the intraocular pressure and the resulting persistent hypotony. Detachment may occur following any perforation of the globe but especially when by reason of imperfect closure of the wound the aqueous continues to escape. The anterior chamber is usually but not necessarily abolished. However, the abolition of the anterior chamber is not a consequence of the detachment, but both are dependent on the one determining factor of hypotony. It is not the absolute hypotony that is important but rather the rapidity with which the intraocular pressure is lowered from its preëxisting level. A slow and gradual lowering, even to the extreme limit, is not sufficient to cause detachment. The effective mechanism is an exaggerated transudation from the choroidal vessels, due to a disturbance of the equilibrium between the pressure in the choroidal vessels and in the ocular cavity, when adequate compensatory mechanisms cannot properly enter into play. In a word, the detachment results from an exaggeration of the normal method of aqueous formation, and the fluid under the detached choroid should be regarded as secondary aqueous or a transudate. Little or no importance should be attributed to senile rigidity of the sclera as a factor in detachment. The sclera is never so rigid that it will not collapse when the intraocular pressure is suddenly lowered, hence the hypothesis of an aspiration *ex vacuo* from the choroidal vessels is untenable.

Even great and sudden hypotony is not sufficient to determine the formation of a choroidal detachment without the intervention of very important predisposing factors linked with anatomic changes in the choroid itself. These predisposing factors are always absent in the young and rare even in the aged. Chief of these factors is the reduced elasticity and distensibility of the choroidal tissue and of the walls of the blood vessels as found in senile involution of the choroid. In consequence, in the young a sudden and persistent hypotony does not result in transudation of fluid and detachment of the choroid, since equilibrium in pressure is rapidly restored by dilatation of the vessels and by edema of the easily dissociated choroidal tissue; whereas with rigidity transudation and detachment are more likely to occur. Without doubt arterial hypertension, which promotes transudation and consequent detachment, and increased vascular permeability of any origin are also predisposing factors. It is very probable that the site of the detachment, which is almost always anterior, is determined by the structure of the vessels in the anterior portion of the choroid, where the large and numerous veins with their simple endothelial walls are essentially blood sinuses.

Orzalesi was unable to produce detachment of the choroid experimentally in either the dog or the rabbit by establishing a fistula to drain the anterior or vitreous chamber. He attributes this failure to the structure of the eyes of these animals and to the absence of the above mentioned concomitant factors.

Harry K. Messenger.

Sien, Auw-Yang. **A case of choroidal apoplexy diagnosed as a sarcoma of the choroid.** Ophthalmologica. **115**: 1-10, Jan., 1948.

A white woman, 56 years of age, complained of sudden loss of vision in her right eye. Examination revealed a normal anterior segment, absence of any red reflex from the posterior segment (upon ophthalmoscopy as well as upon transillumination) and reduction of vision to

bare light perception. The eye was enucleated. The histological examination revealed a fresh intrachoroidal hemorrhage which had originated from a ruptured atheroma of a short posterior ciliary artery. The hemorrhage had broken through the lamina vitrea and caused a well-circumscribed subretinal blood clot. The vitreous was densely infiltrated with red blood cells. Most choroidal arteries showed extensive sclerosis. The author reviews the literature on this rare condition, the spontaneous rupture of an atheromatously diseased choroidal artery or choroidal apoplexy, as he calls it.

Peter C. Kronfeld.

Vouters. **An interesting case of spontaneous choroidal detachment.** Ann. d'ocul. **181**:293-299, May, 1948.

A 67-year-old man observed progressive sight loss of vision in his left eye for six weeks and a positive scotoma. In maximal mydriasis an elevation was observed in the lower peripheral part of each fundus, but more marked in the affected eye. The elevations were gray with a darker background and composed of a number of cell-like compartments or cysts. There was slight pericorneal injection, obliteration of the anterior chamber angle, corneal edema, and increased tension. During several months the vision and the gray plaques observed in the choroid remained unchanged. About one year later the patient died.

The author believes that the lesion was a choroidal detachment secondary to hemorrhage in a patient with a cardiovascular degeneration. Chas. A. Bahn.

9

GLAUCOMA AND OCULAR TENSION

Arkin, Wiktor. **A modification of Elliot's operation and its application to high trephination: A preliminary report.** Am. J. Ophth. **31**:975-978, Aug., 1948. (2 figures.)

Boase, A. J. **Acute glaucoma in an adolescent.** Am. J. Ophth. **31**:997-999, Aug., 1948.

De Leonibus, F. **Further considerations concerning a patient with sympathetic ophthalmia following sarcoma of the choroid.** Boll. d'ocul. **27**:65-75, Feb., 1948.

De Leonibus reported about this patient three years ago, and described the findings in the sarcomatous eye (Boll. d'ocul., 24:266, 1945). In spite of all efforts, the vision in the other eye fell rapidly from 6/10 to amaurosis, the bulbus became soft and very painful and eventually, the second eye had to be enucleated. The time that elapsed was sufficient for complete destruction of the retina and the development of granulation tissue in its place. While plasma cells are a rarity in this lesion, they occurred with great frequency in the author's sections. (4 photomicrographs, bibliography.)

K. W. Ascher.

Lisman, Jack V. **Rubeosis iridis diabetica.** Am. J. Ophth. **31**:989-994, Aug., 1948. (5 figures.)

Payne, Brittain F. **Operative failures for chronic simple glaucoma.** Am. J. Ophth. **31**:965-971, Aug., 1948. (7 figures.)

Posner, A. and Schlossman, A. **The clinical course of glaucoma.** Am. J. Ophth. **31**:915-934, Aug., 1948. (12 figures.)

Romero, Eduardo. **Two statements and a schematic demonstration relative to glaucoma.** Arch. Soc. oftal. hispano-am. **8**:351-354, April, 1948.

Two arguments are presented. One emphasizes the functional antagonism between the circular and radial fibers of the ciliary muscle, and in the other the pathogenesis of glaucoma is attributed to a sympathetic hyperactivity of the radial muscles of the ciliary body. The conten-

tion that the circular fibers focus for near, and the radial for distance is supported by the author's studies and experiments on accommodation, and by the fact that in general, wherever there are longitudinal and circular fibers, their function is antagonistic. The author holds that in spasm of accommodation or transitory myopia only the circular fibers of the ciliary muscle participate. Spasm of the radial fibers, caused by hyperactivity of the sympathetic is manifested by a paralysis of accommodation for near, by a mydriasis because of the synergistic action of the radial fibers of the ciliary muscle and the iris and by ocular hypertension, because the canal of Schlemm is shut by its posterior wall which is formed by the tendon of the radial fibers inserted into the corneoscleral spur. All of these constitute an attack of glaucoma. Romero believes that this pathogenesis of glaucoma has not been known long because the function of the radial fibers in refraction has not been recognized. Romero demonstrates schematically how the effect of sympathetic hypertonicity on the dilator of the pupil, the vascular walls, and the radial fibers of the ciliary muscle leads to obstruction of Schlemm's canal, intraocular hypertension, and venous stasis and how the arterial ischemia and venous stasis lead to nutritive disturbances, degeneration of the ocular tissues, glaucomatous excavation, and visual loss. Ray K. Daily.

Zaretskaya, R. B. **Some experiments with green spectacles prescribed to glaucomatous patients.** Am. J. Ophth. **31**:985-989, Aug., 1948. (4 figures.)

10
CRYSTALLINE LENS

D'Andrade, L. **Direct zonulotomy in intracapsular cataract extraction.** Ophthalmologica **115**:78-83, Feb., 1948.

D'Andrade's direct zonulotomy consists of the breaking of the anterior zonula fibers along the lower half of the lens equator by means of a zonulotome which is introduced underneath the iris and engages the zonula fibers directly. What the actual shape of the engaging part of the zonulotome is, the reviewer is unable to tell from the article or the illustrations. The lens is tumbled and delivered by external pressure applied to the limbus by means of two separate instruments, a "dented compressor" and a "propulsor." The author recommends this method only for senile cataracts in highly myopic eyes, early and late hypermature, and intumescent cataracts. He reports a series of 129 zonulotomies. Vitreous filled the anterior chamber at the end of the operation in 4.1 percent and was lost in another 4.1 percent of the cases. D'Andrade proposes the term total phacectomy instead of the conventional term intracapsular extraction.

Peter C. Kronfeld.

D'Ermo, F. **Three cases of recurrent iritis with hypopyon as a late complication after cataract operation.** Boll. d'ocul. **27**:98-110, Feb., 1948.

In the three cases described extensively, local as well as general treatment proved to be inefficient. All clinical and laboratory examinations were negative except for the successful inoculation of rabbit's cornea with aqueous humor withdrawn during a paracentesis in one of the cases. The possibility of a virus infection in this case was considered. Preoperative bacteriologic tests or antiseptic treatments are not mentioned in the case histories. (References.) K. W. Ascher.

Sen, K. **Anterior lentiglobus. An atypical case.** Brit. J. Ophth. **32**:305-311, May, 1948.

Anterior lenticonus is a small conical projection of the lens at its anterior pole and anterior lentiglobus is a similar ir-

regularity that is globular. Both these conditions are extremely rare. It is confined to the anterior capsule and cortex only and the rest of the lens is unaffected. It has a tendency to increase and because of its high curvature produces myopia. Its cause is unknown.

Sen describes a 14-year-old Sikh who complained of sudden reduction in vision of one eye. Examination revealed a globular projection on the lens partly in the pupillary area and partly covered by iris. Vision was 5/60 and could be improved only by contraction of the pupil to 6/24. It measured 3 by 2 mm. and was egg-shaped. The capsule seemed to be entirely absent over it but this is unlikely because the cortex over it remained clear. The other eye was quite normal. (7 figures.) Morris Kaplan.

11

RETINA AND VITREOUS

Dor. **Retinal detachment cured by intravenous novocaine injection.** Ann. d'ocul. **181**:300-301, May, 1948.

The retina was detached below in a 57 year old man who had noted progressive loss of sight for one month. A preliminary subconjunctival injection of cyanide-novocaine-dionin was followed by improvement. The retinal detachment was apparently due to a spastic lesion which was further reduced by an intravenous novocaine injection. Five months later vision was 0.5 and one year later the retinal detachment had not recurred.

Chas. A. Bahn.

Hambresin, L., and Schepens, C. **Retinal detachment operation with constant ophthalmoscopic control.** Ann. d'ocul. **181**: 257-273, May, 1948.

This interesting contribution marks a step forward in retinal detachment surgery. The authors control the operation for retinal detachment by means of constant ophthalmoscopic examination, and externally by transillumination which is maintained throughout the operation. The binocular ophthalmoscope which is used by the indirect method is mounted on a stand. The combined pyrometric electrode and transilluminator can be sterilized and permits the use of both the right-angled and straight electrodes as well as two transilluminator tips from a common collar on the handle. The electric diathermy mechanism consists of two separate units one for transillumination, and the other for diathermic applications. They are insulated from each other and are regulated by separate foot controls. Before the operative procedure the fundus, including the detachment and tears, is diagrammed on the Weeve Chart which is about eight inches in diameter. A three-man team is necessary for this operation: the surgeon, his assistant and the ophthalmoscopic observer. The procedure consists of a series of superficial applications followed by several perforating applications of 8 to 10 seconds duration. The amount of current is individually determined. Air injections are used according to the Barraquer-Amsler technique. Chas. A. Bahn.

Lijó Pavía, J., and Lis, M. **Obliteration of the central retinal artery. Partial recuperation of vision and retinographic aspects.** Rev. oto-neuro-oftal. **22**:97-104, Sept.-Dec., 1947.

In addition to embolus, thrombus, and local endarteritis as causative fractors in obliteration of the central retinal artery, angiospasm must be considered, and not necessarily in the elderly only. Two cases are reported in which there was sudden loss of unilateral vision and a diagnosis of occlusion of the central artery was made. The fundus picture was typical. Acetyl-choline and nicotinic acid, together with liquemine (an anticoagulant) were administered and some definite im-

provement of vision followed. (5 retinographs.) Edward Saskin.

Pascheff, C. **Angioid streaks of the retina as a transitory phenomenon.** Arch. d'opht. **8**:152-155, 1948.

Pascheff reviews the various theories of the origin of angioid streaks and reports a case which he was able to follow for eight years. The patient, a woman of 32 years, did not have the commonly associated pseudoxanthoma elastica or diabetes but did have typical angioid streaks in both eyes and reduced vision. Seven years later the streaks had disappeared completely and vision had notably improved in each eye. In commenting on the case, the author describes the condition as a veritable melano-reticular retinitis and notes that both the vascular hypothesis and the hypothesis of rupture of the lamina vitrea are untenable in view of the result in this case. He considers a metabolic disorder the probable cause. In his patient the sole discoverable metabolic abnormality was a hypercholesteremia and this was still present after the disappearance of the streaks. Pascheff concludes that the streaks are probably an infiltration with pigment.

Phillips Thygeson.

Scuderi, G. **Exudative affections of the external layers of the retina of tuberculous nature. Part I.** Rassegna ital. d'ottal. **17**:103-128, March-April, 1948.

Scuderi divides the rather rare and not too well understood affections of the external layers of the retina into two groups. The juvenile form includes Coats's disease, the macular juvenile form of Junius, and the central serous retinitis of Masuda. The senile group is composed of the disciform degeneration of Junius and Kuhnt, exudative senile macular retinitis, central chorioretinitis with arteriovenous anastomosis of Oeller, the fibrochondroma of the elastic layers, exudative retinitis with bone formation of Axenfeld, the tumor-like accumulation of tissue at the macula of Elschnig and the senile macular alterations of arteriosclerosis (Possek).

Radiographic examinations of the writer's patients disclosed alterations of the hilar lymph glands from which he believes that tubercle bacilli, or more probably their toxins, find their way into the circulation and, passing through the choriocapillaris to the epithelial pigment, give rise to an abnormal secretion.

Two cases are reported and the literature reviewed. (8 figures.)

Eugene M. Blake.

Vail, Derrick. **Some thoughts on the surgery of retinal detachment.** Wisconsin M.J. **47**:687-689, July, 1948.

The essentials for success in the treatment of retinal detachment were recognized and clearly stated by Gonin. They are the finding of a tear, hole, or disinsertion of the retina, the exact localization of the hole, the production of adhesive choroiditis in the area of the hole and nowhere else, and the evacuation of the subretinal fluid. The penetrating needle should not be too long. The anaesthetic of choice is pentothal sodium. The cornea should be kept clear for frequent ophthalmoscopic examinations during the operation. Scleral resection should be done if a scleral staphyloma is the cause of the detachment. The ciliary region and the vortex veins should be avoided. The prognosis is poor when there are delayed hemorrhages, a severe postoperative reaction, bilateral spontaneous idiopathic retinal detachment and when the retina has not returned to its normal position and the pigmented scars of the ignipuncture are not easily visible at the end of three weeks.

I. E. Gaynon.

Winkelman, J. E. **Angioid streaks.** Ophthalmologica **115**:84-88, Feb., 1948.

Winkelman reports the case of a white female patient, 72 years of age who died of heart failure. A conspicuous clinical

finding was the presence of multiple pseudoxanthomata elastica. Because of this finding, the patient's eye grounds were examined carefully just before her death, but no angioid streaks were found. Histological examination, however, revealed the typical pathological changes of Bruch's membrane (thickening, ruptures, abnormal staining reactions) which have been described by Böck (Zeitschr. f. Augenheilk. 95:1, 1938 and Hagedoorn (Arch. of Ophth. 21:746, 1939). These changes may therefore be present before the angioid streaks become ophthalmoscopically visible. Peter C. Kronfeld.

12

OPTIC NERVE AND CHIASM

Casanova, José. **Papilledema.** Arch. Soc. oftal. hispano-am. **8**:221-290, March, 1948.

This extensive monograph comprises a thorough review of the literature, and a comprehensive bibliography, classified under the headings of symptomatology and diagnosis, pathologic anatomy, pathogenesis, clinical significance, and therapy. The original features of the monograph are two colored fundus drawings, and visual fields in a case of serous meningitis, and one of gumma of the occipital lobe; the histo-pathologic material used to illustrate the chapter on pathologic anatomy; and a report of Casanova's investigations with injections of China ink into the intervaginal space of a cadaver after doing an orbital exenteration. As the photomicrographs demonstrate, the ink is seen to distend the intervaginal spaces, but does not penetrate into the lymphatic spaces about the central retinal vessels, or extend through the perivascular spaces towards the dural surface.

Ray K. Daily.

13

NEURO-OPHTHALMOLOGY

Raski, K. **Concentric contraction of the visual fields in gunshot wound of the brain and in brain contusion.** Acta ophth. Suppl. 29, 1948, pp. 1-137.

Brain lesions caused by trauma either of lighter degree or severer cerebral contusion were followed by a concentric contraction of the visual fields. The region of the brain affected by the trauma had no direct influence on the concentric contraction of the visual field. The visual field for white was contracted in 78.4 percent and for color in 96.8 percent. The greatest contraction occurred for blue whereas the field for red was less affected. The visual field changes persisted and could be ascertained even after the lapse of several years. Psychogenic disturbances evidently had no effect on the result of the visual field changes. R. Grunfeld.

Rich, W. M. **Permanent homonymous quadrantanopia after migraine.** Brit. M. J. pp. 592-594, March 27, 1948.

Permanent quadrantanopia, in the patient's superior right visual fields, following twenty years of repeated attacks of idiopathic migraine is described. It is assumed that the defect results from permanent occlusion of the vessels, with softening of the brain tissue, after a long period of merely functional disorder, rather than the possibility that the friction from an ossified clinoid ligament damaged the optic tract. A review of the literature is given. (4 figures, references.)

Bennett W. Muir.

Smorto, Guido. **Some ocular reflexes in electroshock convulsion.** Riv. oto-neuro-oftal. **22**: 272-291, July-Aug., 1947.

In 22 patients, 15 of them men, affected by schizophrenia, melancholia, or psychasthenia, the behavior of the reflex ocular movements in convulsion from electric shock was tested at the beginning of the tonic phase and during the comatose phase. In the tonic phase, when the epileptogenic stimulus slowly expands, an initial crossed rotation of the head and the eyes was noted. This is a tonic reflex

originating in the deep receptors of the neck. During the comatose phase compensatory ocular movements were noted which the author relates to stimuli originating in the nonacoustic labyrinth.

Melchiore Lombardo.

Wagner, H. P. **Visual hallucinations.** Am. J. M. Sc. **215**:226-232, Feb., 1948.

Visual hallucinations are not due to local cortical excitability but are psychic phenomena involving the total integrative activities of the mind. Visual memory and visual experience are necessary for visual hallucinations, as it is well known that congenitally blind children do not have visual hallucinations. As to the localizing value of visual hallucinations, much data has been collected, and a careful study reveals that there is none, except that when the hallucinations are projected in a blind homonymous field it is a confirmatory sign that the lesion is located in the contralateral hemisphere. Many clinicians believe, however, that complex lateral visual hallucinations furnish supportive evidence that the lesion is in the temporal lobe, and unformed ones originate in lesions of the occipital lobe.

Orwyn H. Ellis.

Weekers, Roger. **Tonic pupillary reaction (Adie's syndrome) following retrobulbar alcohol injection.** Ann. d'ocul. **181**: 193-198, April, 1948.

The retrobulbar injection of ethyl alcohol is not infrequently employed in Europe to relieve ocular pain, especially in blind eyes. Among the infrequent complications following its use is a transient extraocular muscular weakness and the more permanent tonic pupillary reaction (Adie's syndrome). Four cases of the latter are reported. The semidilated pupil in the second stage reacts imperfectly with accommodation and convergence, and does not react at all to light. Myosis is promptly produced by cholinergic drugs that are stable derivatives of acetylcholine, but not to cholinergic drugs that inhibit or destroy cholinase. The former group includes acetylbetamethylcholine (mecholin), the latter, eserine and D.F.P. which have no myotic effect. Adrenergic drugs such as adrenalin produce only slightly increased dilatation which proves that the sympathetic mechanism is not involved.

Chas. A. Bahn.

14

EYEBALL, ORBIT, SINUSES

Babel, J. **Chronic orbital myositis.** Ophthalmologica **114**:312-319, Oct.-Nov., 1947.

The clinical symptoms of chronic orbital myositis are: (1) slowly progressive, painless, irreducible exophthalmos without lateral or vertical displacement of the eyeball; (2) lid edema, often associated with ptosis and chemosis, and always associated with dilation of the conjunctival vessels; (3) limitation of active ocular movements in all directions, and (4) limitation of passive ocular movements (Dunnington and Berke, Arch. of Ophth. 30: 446, 1943). These four symptoms do not always permit the differentiation of chronic myositis from true orbital tumors, inflammatory pseudotumors and orbital diseases due to endocrine disturbances. With very rare exceptions, chronic orbital myositis is a disease confined entirely to the orbit (or in one-fourth of the cases to both orbits), without involvement of any extraorbital muscles, without any signs of thyroid or pituitary dysfunction, without any blood dyscrasia and without any circulatory disease (other than arteriosclerosis in elderly patients). Keeping all these possibilities in mind, the diagnosis on the basis of the clinical findings may be so uncertain that orbital exploration and biopsy are resorted to. The author describes a case in which the presence of an orbital tumor was suspected. Exploration

of the orbit revealed fibrosis, an abundance of dilated blood vessels and, posteriorly, a hard mass, pieces of which were removed. Histologic study disclosed a diffuse, inflammatory process which was much more pronounced in the muscles than in the interstitial fatty tissue. The author believes that the characteristic difference between chronic myositis and inflammatory pseudotumors is the specific involvement of the orbital veins in the former disease. More thorough clinical investigation of the circulatory disturbance may permit recognition of chronic myositis. Another clinical clue may be a limitation of ocular movements out of proportion to the degree of exophthalmos.

Peter C. Kronfeld.

Cibis, P. **A new plastic implant made of "Supramid" for sockets after enucleation.** Klin. Monatsbl. f. Augenh. **112**:313-316, 1947.

A plastic ball implant is described which has a central tubular hole which penetrates almost its whole diameter. Plastic sutures or catgut are threaded into this tubular cylinder through two small openings at the base and leave it at the opposite side. After the implant is in place, the sutures are threaded through the four rectus muscles and through Tenon's capsule in the usual circular fashion. Firm connection between implant and overlying muscle is thereby established and leads to good movements of the base of the socket and the prothesis. The recently developed implants by American authors are not mentioned. (References.) Max Hirschfelder.

Devoe, A. G. **Fractures of the orbital floor.** Tr. Am. Ophth. Soc. **45**:502-526, 1947.

Thirty-four cases of fracture of the orbital floor were observed. The immediate care of such fractures will rarely be an ophthalmological problem because of the multiplicity of injuries, often of a vital nature, which usually accompany the condition. Immediate treatment is reviewed. Late treatment which may take the form of operation on the extraocular muscles or substitution of inert material in the orbital floor is in the province of the ophthalmologist. Restoration of the orbital floor may improve the cosmetic appearance. David O. Harrington.

Doctor, L., and Kennedy, R. J. **Tumors of the orbit.** Cleveland Cl. Quart. **15**:99-103, April 1948.

A brief review of the clinical manifestations and incidence of orbital tumors is given. The measurement of exophthalmos with a forward displacement over 20 mm. is the most consistent finding. The use of additional diagnostic methods and the differential diagnosis is discussed. The treatment varies with the final diagnosis. Operation should be performed when visual acuity becomes endangered.

A neurilemmoma in a woman 50 years of age is reported with the description of the tumor; a lymphosarcoma in a 65-year-old man (a tumor which involves muscle as well as the eyeball) is described and finally a report of an adenocarcinoma of lacrimal gland which is cylindroma in type is given. (1 figure.)

H. C. Weinberg.

Favory, Albert. **Some new points in the technique of implant in Tenon's capsule after enucleation.** Brit. J. Ophth. **32**:366-372, June, 1948.

The author presents an acrylic implant for use after enucleation. The implant is essentially a ball, 10 mm. in diameter, with four arches for the attachment of the rectus muscles and a square projecting peg. Tenon's capsule and the conjunctiva cover all but the peg which finally is fitted into a square hole in the back of the specially made prosthesis. In a further modification the projecting arches were re-

placed by a disc which had four kidney-shaped holes for the attachment of the rectus muscles. Silk is used in suturing the muscles and this, after being passed a second time through the muscle tendon, is passed out through the conjunctiva and tied. Good results followed two early failures. Orwyn H. Ellis.

Fischer-Galati. **Myositis and subacute orbital cellulitis.** Ann. d'ocul. **181**:302-303, May, 1948.

A previous contribution is briefly discussed and the following case is presented. A 64-year-old man complained of pain and decreased vision that had followed the feeling of a foreign body in his left eye. Only slight conjunctival injection was found. Three days later a progressive monocular exophthalmus developed. Improvement began after the use of penicillin and treatment of the diseased maxillary sinus. Chas. A. Bahn.

Gát, L. **The plastic repair of symblepharon.** Ophthalmologica **114**:414-418, Dec., 1947.

The original title of this paper is "on partial plasty of the socket." Actually it deals with the plastic repair, by means of mucous membrane grafts from the mouth, of posterior or total symblepharon in the presence of a seeing eye. In posterior symblepharon in which there is enough bulbar conjunctiva to line the fornix the tarsal conjunctiva is incised parallel to and close to the lid border and undermined toward the bony orbital margin. Thus enough conjunctiva becomes available to form a fornix. The resultant defect of tarsal conjunctiva is filled in with mucous membrane. In total symblepharon the scar tissue is completely removed and both walls of the resultant cavity are lined with *one* mucous membrane graft wrapped around a thin piece of properly shaped plastic or stent composition.

Peter C. Kronfeld.

Grignolo, Antonio. **Results of penicillin treatment in ocular complications of septic thrombophlebitis of the cavernous sinus, with particular consideration of a case complicated by bilateral occlusion of the central retinal arteries.** Boll. d'ocul. **26**:749-763, Dec., 1947.

In spite of the early administration of penicillin in large doses the patient, a man 38 years of age, developed bilateral occlusion of his central retinal arteries on the fifteenth day of his disease. This rare complication is extensively discussed. (Bibliography.) K. W. Ascher.

Hickman, W. R., **Periorbital cellulitis; a report of four cases.** J. Indiana St. M.A. **41**:501-504, May, 1948.

Periorbital cellulitis is uncommon and in children and young adults is secondary to sinusitis. Findings are edema and redness of both lids on the affected side, pain in and over the affected eye, elevated temperature and generalized headache. The combined use of sulfamines and penicillin is most effective. Pus must be evacuated. Irwin E. Gaynon.

Hughes, W. L. **Further experiences with integrated eyes and vitallium implants.** Am. J. Ophth. **31**:854-860, July, 1948. (3 figures, 5 references.)

Kniper, A. **Roentgentherapy of an orbital pseudotumor.** Boll. d' ocul. **26**:719-723, Nov., 1947.

Pseudotumors of inflammatory character are recognized by long duration and recurrent deteriorations. Surgical intervention is not advisable because of the good effect following irradiation. (1 photomicrograph, bibliography.)

K. W. Ascher.

Lederer, J. **Folliculine in some cases of thyroid exophthalmus.** Ann. d'ocul. **180**: 37-45, Jan., 1948.

Exophthalmus decreased after follicu-

line administration in five patients. All patients were women in the fourth decade whose ovarian functions had been eliminated surgically or because of the climacteric. In each case the exophthalmus followed decreased ovarian function, varied from 2 to 7 mm., and was binocular. Folliculine administration is indicated in the thyrotropic form accompanied by defective ovarian function. This form is apparently due to imbalance of the diencephalic mechanism which coordinates individual glandular activities into patterns of vasomotor function. Endocrine exophthalmus in one sense is a glaucoma in the orbit. The retained fluid produces degenerative changes in the orbital tissues. Chas. A. Bahn.

Montresor, Dante. **Orbital inflammation treated with penicillin.** Ann. di ottal. e clin. ocul. **73**:92-96, Feb., 1947.

Treatment with sulfonamides of a 36-year-old man with an infiltrative phlegmon of the left orbit and signs of cavernous sinus thrombophlebitis had been ineffective and had caused anemia. The response to penicillin was prompt and rapid, and complete recovery resulted.

Harry K. Messenger.

15

EYELIDS, LACRIMAL APPARATUS

Cassady, J. V. **Dacryocystitis of infancy.** Am. J. Ophth. **31**:773-780, July, 1948. (7 figures.)

Cockrum, W. M., Slaughter, H. C., Lynch, H. D., and Austin, E. W. **Styes: the role of nutrition in etiology and treatment.** J. Indiana St. M.A. **41**:489-491, May, 1948.

The authors found that styes occur in children who are on a low protein-high carbohydrate diet, regardless of their economic state. A well-balanced protein intake, with minerals and vitamins is most important, whereas local treatment, refraction and search for foci are procedures of secondary importance.

Irwin E. Gaynon.

Couzi, J. **Staphylococcal blepharitis.** Ann. d'ocul. **181**:274-292, May, 1948.

In a series of 48 patients with blepharitis it was shown by accepted laboratory methods that the staphylococcus was the cause in 46. This same ratio has been previously verified. An anatomical classification is preferred. Cutaneous lesions may be eczema, impetigo, herpes, psoriasis, pemphigus, or the lesion may be predominantly glandular or ciliofollicular. The allergic or hypersensitive factor is manifested by a quantitative and qualitative disproportion of effect and cause. The number of potential allergens is tremendous. Tissue hypersensitivity may be local, as determined by intradermal tests, or bodily, as determined by tests such as that of Pausnitz-Kustner or by eosinophilic increase. Refractive errors may aggravate blepharitis because both have photophobia. Its reduction with correcting lenses potentially reduces blepharospasm through improved marginal venous circulation.

The author concludes that most of the eye drops, washes and compresses frequently used in the treatment of blepharitis retard rather than hasten recovery. Much more important are the expression of abnormal secretion from the oil glands, the removal of diseased lashes and crusts, and the avoidance of physical or chemical irritation. Penicillin and sulphonamides are the most effective remedies. The latter has been found the less efficacious. Resistance to penicillin is not infrequent and may occur immediately or after a time. The local or extraocular use of both drugs singly or together may be advisable and 2,500 units of penicillin combined with a sulpha compound, cod liver oil, vaseline and lanolin is preferred

for local use. In the general desensitization of these patients regulation of their way of life is of primary importance. Hemo- and autoserotherapy have sometimes been followed by improvement. More efficient are autovaccines injected into the lids. Stock vaccines have not been found satisfactory.

Chas. A. Bahn.

Dupertuis, S. M. **Eyelid reconstruction in the blinded.** Plast. and Reconstruct. Surg. **3**:269-282, May, 1948.

A series of ten war casualties is utilized to illustrate various principles and procedures used in the reconstruction of the eyelids of anophthalmic sockets.

Twenty-eight photographs and four excellent plates of surgical diagrams in sequence illustrate the article.

Alston Callahan.

Espildora Luque, C., Mosser, J., and Gormaz, A. **Sjögren's syndrome.** Arch. Soc. oftal. hispano-am. **8**:333-350, April, 1948.

A review of the literature is followed by a brief report of nine cases. In none of these was there any demonstrable anatomic change or hypertrophy of the lacrimal glands. One patient related that the disturbance set in with swelling of the salivary, parotid, and submaxillary glands, and an annoyance in the upper lids which was probably caused by a swelling of the lacrimal glands. When first seen these swellings had disappeared and there was marked atrophy of the parotid glands. Another patient with marked gross hypertrophy of the parotid actually had a pseudohypertrophy, and as shown photomicrographically, the glandular elements were replaced by fibrous tissue. Mosser devised a quantitative test for the dryness of the mouth, similar in principle to Schirmer's test. He placed the filter paper at angles of the mouth. All nine patients suffered to some extent from arthritis, the symptoms of which preceded symptoms of Sjögren's syndrome. Three patients who had gastric analysis were found to have achylia and hypochlorhydria. Since it is generally believed that Sjögren's syndrome is a disease of the menopause, it is worthy of note that one of the patients became affected at the age of eleven years and one at 26. An unusual history is that of the patient in whom the disease set in at the age of 33 years with an acute attack of dryness of the lids, mouth, and throat after an electric shock. Cauterization of the lacrimal puncta with a thermocautery is recommended as the most effective means of alleviating the ocular discomfort. Vitamin therapy is used with variable and uncertain results. (7 figures.)

Ray K. Daily.

Fuchs, A., and Wu, F. C. **Sleep with half-open eyes (physiologic lagophthalmus).** Am. J. Ophth. **31**:717-720, June, 1948. (9 figures, 2 tables.)

Heath, Parker. **Mikulicz's disease and syndrome.** Am. J. Ophth. **31**:955-964, Aug., 1948. (12 figures.)

Hirschfelder, M. and Frost, J. **Carcinoma of the inner canthus and forehead.** Am. J. Ophth. **31**:999-1001, Aug., 1948. (2 figures.)

Jorio, S. **Concerning blepharoplastic surgery.** Rassegna ital. d'ottal. **17**:85-103, March-April, 1948.

After a historical review of plastic surgery of the eyelids Jorio describes in detail and illustrates with pictures the method he used in a variety of deformities. Some were corrected with sliding flaps, some by torsion flaps and others with Wolfe grafts. Grafts were removed from the postauricular region or from the inner surface of the arm.

Many years of experience in lid surgery have lead the author to the conclusion that patients are often late and distrust-

ful in seeking surgical relief, but that good functional and cosmetic results may be obtained if the procedure is not postponed too long. (27 figures.)

Eugene M. Blake.

Kettesy, A. **On genesis and operation of senile entropion.** Brit. J. Ophth. **32**: 311-313, May, 1948.

Senile or spastic entropion is a simple turning in of the unchanged tarsus of the lower lid. Normally, the lid is held in proper position by two forces: the tarso-orbital fascia and the equally distributed tension of the orbicularis muscle.

The latter plays the much more important role and its normal distribution is maintained by connective tissue which branches between the bundles. In senility there is a slackening of this connective tissue so that the orbicularis becomes a single bundle near the margin of the lid and the disturbance of the distribution of pressure results in entropion. Remedial measures which do not repair this cause can only result in recurrence or, if overdone, in ectropion.

The solution of the problem is excision of the orbicularis muscle, nothing further. Under local anesthesia, with a lid plate in the lower fornix, a skin incision is made immediately below the lashes and the skin is undermined down to the orbital margin. The palpebral part of the muscle as well as the lower portion is thoroughly extirpated until tarsus and orbital fascia are exposed. Sutures are unnecessary as coaptation is perfect. The results are immediate and lasting and lid action remains perfectly normal. Removal of skin is never done and over-correction is not possible.

Morris Kaplan.

Kurz, O. **Unusual causes of blockage of the lacrimal passages.** Ophthalmologica **115**:101-109, Feb., 1948.

A chalazion had perforated into the lower canaliculus. After incision and careful curettage of the chalazion by the conjunctival approach the canaliculus was sutured. The final result was excellent (no lacrimal fistula, no tearing).

In a second patient there was eversion of the lower punctum by a small tumor located on the conjunctival surface just below the border of the lid. Excision of the tumor augmented by the excision of a rhombic piece of tarsus and conjunctiva just below the tumor corrected the eversion of the punctum and the epiphora. The tumor consisted of lymphoid tissue.

Elongation and kinking of a lower canaliculus, probably after trauma (incomplete rupture) was corrected by plastic repair in a third patient.

Peter C. Kronfeld.

Malatesta, C. **Width of the lid fissure and length of the lacrimal canaliculi.** Boll. d'ocul. **27**:88-97, Feb., 1948.

In 1916, Van der Hoeve described a congenital anomaly consisting of a reduction in length of the lid fissure, internal ankyloblepharon, a wide nasal base, enlargement of the lacrimal caruncle, and elongation of the lower lacrimal canaliculi. Similar but not identical cases were reported by Halbertsma (1929), Gualdi (1930), Leonardi (1931), Tirelli (1932), and Waardenburg (1933). Three cases are described, photographed, and the exact measurements reported in a table; the main findings are congenital ptosis, epicanthus, reduction in width and in length of the lid fissure, fusion of the lids at their internal extremities, increased distance of the nasal canthi from each other with normal interpupillary distance, and elongation of the lacrimal canaliculi. (References.)

K. W. Ascher.

Panzardi, D. **Results of the operations by Blaskovicz and by Bietti for the correction of a permanent trachomatous ptosis.** Boll. d'ocul., **27**:76-87, Feb., 1948.

The author operated on six eyes with permanent trachomatous ptosis, two of them by the original method of Blas-

kovicz, one by the method of Blaskovicz as modified by the author, and three by Bietti's method. Panzardi gives a new explanation of the pathogenesis of permanent trachomatous ptosis. A cicatricial mass which joins the levator palpebrae to the large palpebral ligament is responsible for this type of ptosis. Eight photographs show patients before and after operation. (Bibliography.)

K. W. Ascher.

16

TUMORS

Anastasi, Giovanni. **On the histogenesis of the limbal epithelioma.** Ann. di ottal. e clin. ocul. **73**:65-82, Feb., 1947.

Anastasi presents nine cases of epithelial neoplasm of the limbus in ascending order of their supposed histogenesis: a simple tyloma, an atypical tyloma, a simple papilloma, a papilloma in an early stage of transformation into a basal cell epithelioma, a papilloma undergoing transformation into a prickle cell epithelioma, a mixed papillomatous epithelioma, with proliferation of both the prickle cell layer and the basal cell layer, a prickle cell epithelioma, an invasive (terebrant) prickle cell epithelioma, and a basal cell epithelioma.

Contrary to Poleff, whose histogenetic scheme posits the existence of an "initial epithelioma," Anastasi considers that the histogenesis of limbal tumors can be explained on the basis of our knowledge of tumors in general. They are characterized by a gradual increase in alteration of the cells, which become more and more atypical as they go from precancerous forms (in tyloma and papilloma) to the truly cancerous prickle cell and basal cell forms. The differential diagnosis is not always possible clinically but is easily made histologically. The proper treatment is still surgical, though X-ray and radium therapy may be used as adjuncts. (25 figures, including 18 photomicrographs.) Harry K. Messenger.

Calhoun, F. P., Jr. **Pigmented lesions of the eye and adnexae.** J. Med. Assn. Georgia **37**:140-141, April, 1948.

Various pigmented conditions that involve the conjunctiva, lid, and uveal tract are briefly discussed. In early life the appearance of an area of pigmentation in the conjunctiva, or an increase in its size, may not connote serious trouble but in the adult these changes may be signs of danger. Rational therapy can be employed only after proper histologic study of the lesion, and complete local excision for this purpose where possible is recommended.

Bennett W. Muir.

D'Aquila de Castañe Decoud, A. **Histopathology of ocular gliomas.** An. argent. de oftal. **8**:41-45, April-May-June, 1947.

Histogenetically, nervous tumors manifest themselves as astrocytomas, oligodendrogliomas, and other forms, whereas gliomas are either glial or nervous. The author presents the Bailey-Cushing histo-evolutionary classification of gliomas as opposed to the Hortega classification. Both these groupings, however, make use of the glial or neuroepithelial origin of the neoplasms. In the cases presented, the author feels that embryologically the undifferentiated type of retinal glioma is extremely malignant, whereas the optic nerve type of glioma has a much slower growth without metastasis (sic). Histologically, glio-epithelial perivascular pseudo-rosettes were commonly found and true rosettes were found in but one case. (8 figures, 1 table, references.) Edward Saskin.

Dellaporta, A. **A case of bilateral malignant lymphomatous infiltration (lymphosarcoma?) of the lids of a four-year-old boy.** Proc. Ophth. Soc. Vienna. p. 85, Oct. 23, 1944.

One week after small-pox vaccination a sudden indolent swelling of the lids appeared in a four-year-old boy. In the beginning it was present only during the night and disappeared almost completely during the day time. The skin and conjunctiva were not involved. Beneath the skin, inside the orbital rims, pea-sized globular masses could be felt in the orbital tissue behind the skin-muscle layer of the lids. Very small retro-auricular glands were palpable. Blood count and the bone marrow obtained by sternal puncture were normal. Biopsy of one of the nodules revealed malignant lymphomatous tissue, possibly lymphosarcoma. The child died a few months later. F. Nelson.

Dunnington, J. H. **Granular cell myoblastoma of the orbit.** Tr. Am. Ophth. Soc. **45**:93-101, 1947.

Granular cell myoblastoma is a relatively common tumor found in different locations throughout the body. Its occurrence in the orbit is rare. Two tumors are reported that arose in the orbit, one of which was malignant. There is no characteristic clinical picture and the differential diagnosis is purely a histologic one. In spite of a considerable literature on the subject there is still much confusion in terminology.

David O. Harrington.

Edgerton, A. E. **Chloroma: report of a case and a review of the literature.** Tr. Am. Ophth. Soc. **45**:376-414, 1947.

This very complete review of the subject of chloroma presents the clinical and pathological picture of the disease, lists 366 cases collected from the literature and reports one new case in great clinical and pathologic detail.

David O. Harrington.

Hutchinson, B. B. **Management of intra-ocular foreign bodies.** Texas St. J. Med. **44**:48-51, May, 1948.

Intraocular foreign bodies must be demonstrated by direct observation and X-ray if possible. A penetrating wound in the avascular portion of the globe with subconjunctival hemorrhage is indicative of a double perforation. The Sweet method of localization is most accurate. Anterior chamber foreign bodies may be removed through keratome incision at an angle of 45 degrees. Nonmagnetic foreign bodies in the lens may be allowed to remain in situ. Posterior segment foreign bodies should be removed through a scleral incision, followed by a diathermy barrage about the wound.

Irwin E. Gaynon.

Levitt, J. M. **Malignant melanoma of the iris.** Am. J. Ophth. **31**:863-864, July, 1948. (1 figure.)

Matteucci, P. **The melanogenesis of uveal sarcomas. On the oxidation of tyrosine and 3,4-dioxyphenylalanine in melanotic uveal tumors and in the normal human uvea.** Ann. di ottal. e clin. ocul. **73**:183-186, March, 1947.

Tyrosine and 3,4-dioxyphenylalanine are readily oxidized when introduced into a preparation of neoplastic tissue obtained from melanotic sarcomas of the choroid, whereas their addition to preparations of normal human uveal tissue has no effect on the consumption of oxygen. In the case of normal choroidal tissue the results of this study accord with those of other investigators, but the data referring to tumor tissue are entirely new. Matteucci's experiments seem to confirm the hypothesis that the tumor pigment melanin has its origin in the neoplastic cells themselves. Harry K. Messenger.

Radnót, M. **Flat sarcoma of choroid.** Ophthalmologica **114**:409-414, Dec., 1947.

There were two cases of "flat sarcoma" of the choroid among the 53 eyes with uveal sarcoma enucleated and examined

histologically at Imre's clinic in Budapest during 1940 to 1943. Because of its extensive contact with ciliary vessels and nerves the flat sarcoma invades and perforates the sclera earlier and in more places than the circumscribed inward-growing sarcoma. Peter C. Kronfeld.

Schmid, M. **Local recurrence of a melanosarcoma of the iris after extirpation of the tumor.** Proc. Ophth. Soc. Vienna. p. 82, Oct. 23, 1944.

A triangular pigmented tumor in the lower half of the right iris of a 40-year-old woman, extending from the chamber angle toward the pupillary margin and touching the posterior surface of the cornea was excised thoroughly. Apparently healthy tissue of the adjacent sector of the ciliary body was included. Histologic examination revealed a melanosarcoma. After three years recurrence in the sclera near the operative scar and nevoid pigmentations in the nasal section of the iris were found. Histologic examination of the enucleated globe revealed an infiltrating growth of pigmented spindle cells and confirmed the diagnosis.

F. Nelson.

Schulz, M. D., and Heath, P. **Lymphoma of the conjunctiva.** Radiology **50**: 500-505, April, 1948.

The authors summarize the scanty reports both in the radiologic and ophthalmic literature on this rare condition. The cytology of the lesions is presented and classified. Treatment was successful in lymphoma limited to the conjunctiva, but in contrast to these, all patients whose conjunctival involvement was part of a generalized condition were dead in less than two years, or had uncontrolled disease. Orwyn H. Ellis.

Vrabec, F. **Melanoblastoma of the human choroid cultured in vitro.** Ophthalmologica **115**:129-140, March, 1948.

With Carrel's method of tissue culture Vrabec obtained good in vitro growth from four cases of malignant melanoma of the choroid. P. C. Kronfeld.

17
INJURIES

Grant, W. M. **Ocular injury due to sulfur dioxide.** Arch. Ophth. **38**:755-761, Dec., 1947.

Ocular injuries result from spraying of liquid sulfur dioxide and oil into eyes in refrigeration accidents. Four such cases are described in detail. The injuries were characterized by immediate damage to the corneal epithelium, as in acid burns, with underlying stromal and endothelial injury as in alkali burns. There is an early absence of severe pain, due apparently to a temporary anesthesia. In mild injury the outcome was complete recovery, while in severe damage dense opacification followed corneal infiltration and interstitial vascularization. John C. Long.

Leon Gangoso, Martin. **Traumatic aphakia and aniridia.** Arch. Soc. oftal. hispano-am. **8**:402-403.

A 19-year-old food handler sustained a blow on the left eye, which perforated the globe and led to a complete loss of the iris and lens, and an intraocular hemorrhage. The intraocular blood gradually became absorbed and the eye recovered with a visual acuity of two-thirds, with a +9.00D. lens. The question of estimating the visual disability for legal purposes is raised, inasmuch as there is no binocular vision with unilateral aphakia but if his good eye were injured a unilateral visual acuity of two-thirds would permit him to continue his occupation. Ray K. Daily.

Marucci, Luigi. **A simple apparatus for outlining directly on the X-ray film information for the localization of intraocular metallic foreign bodies by the**

method of **Comberg Borsotti.** Giorn. ital di oftal. 1:36-46, Jan.-Feb., 1948.

The author briefly reviews the Comberg-Borsotti method of localization of intraocular foreign bodies and describes the Dufour technique. In the latter one uses the ring of Goldman and Bangerter, exposes two films, one anteroposterior and the other lateral and uses a transparent screen for outlining directly on the film the position of the foreign body. He then describes an original apparatus which allows direct reading of the position of the foreign body, both in the antero-posterior and the lateral view. The two schematic representations of Dufour are retained but one needs neither geometry nor drawing instruments.

Francis P. Guida.

Wall, Walton. **Acute tetanus following a perforating injury of the eye.** Eye, Ear, Nose and Throat Monthly. 27:179-182, April, 1948.

The author reports an interesting case of acute tetanus that occurred five days after a perforating ocular injury. Although the incubation period was probably prolonged by its use, penicillin did not seem to affect the clinical course of the disease. The patient responded to antitoxin. In reported cases the mortality for this condition is high.

Orwyn H. Ellis.

18

SYSTEMIC DISEASE AND PARASITES

Anderson, W. B., Nicholson, W. M., and Iverson, L. **Temporal arteritis with associated optic atrophy.** South. M. J. 41: 426-434, May, 1948.

Two case reports are given of temporal arteritis with optic atrophy caused by occlusion of the central retinal artery. Ocular signs occur in about one-third of the reported cases. The pain of the arteritis seems to be helped by section of the vessels for histologic study. The etiology is entirely obscure. (Bibliography, 8 figures.)

Bennett W. Muir.

Bansi, H. W. **The pathological physiology of undernourishment and deficiency diseases.** Klin. Monatsbl. f. Augenh. 112: 289-299, 1947.

This article was written for the postgraduate education of German specialists, particularly oculists, who in the Europe of today are in close contact with various stages of undernourishment. It discusses metabolic happenings during qualitatively and quantitatively deficient protein intake, the disturbed metabolism of nitrogen and oxygen and the various vitamin deficiencies. One finds disturbances in the field of enzymes and hormones, hypothyroidism, hunger edemas and pathological behavior of the liver function.

Max Hirschfelder.

Böck, J. **Subretinal cysticercus.** Proc. Ophth. Soc. Vienna p. 89, Dec. 11, 1944.

In the macular region of the retina of a man, 48 years of age, a round bullous lesion was found about 1.5 disc diameters in size. At its lower border hemorrhages and white spots were seen. The disc was blurred and somewhat prominent. The vitreous body was opaque and detached posteriorly. Four weeks after the first examination the focus had doubled in diameter and the worm could be observed moving inside the cyst. Cysticercus reaction was positive in the blood. After temporary detachment of the external rectus and the inferior oblique muscles the sclera was incised with guidance of the localizing method of Weve-Lindner by transillumination. After incision no choroidal tissue was seen and no hemorrhage occurred probably because the choroid had been changed by the presence of the cysticercus. The cyst could be removed in toto. Resulting vision was 2/60. The cysticercus reaction in the serum be-

came negative within a few weeks and remained negative. F. Nelson.

Brinkhorst, C. D. **Toxoplasmosis.** Ophthalmologica **115**:65-77, Feb., 1948.

The author reports a case of a six-year-old girl with characteristic symptoms of toxoplasmosis, namely psychomotor disturbances, microcephaly, microphthalmos and chorioretinitis. The clinical diagnosis was confirmed by the demonstration of toxoplasma-like parasites in animals inoculated with the patient's spinal fluid. "This is the first case known in the European literature, in which the diagnosis was made intra vitam, and it is one of the few non-fatal cases of infantile toxoplasmosis described." The author also reports three other, less conclusive, cases and reviews the literature.

Peter C. Kronfeld.

Bruce, G. M. **The ocular fundus in pheochromocytoma of the adrenal gland. Report of three cases.** Tr. Am. Ophth. Soc. **47**:201-228, 1947.

Three cases of this condition in children, all showing retinal lesions are reported. The literature is reviewed with special reference to ocular pathology. The dominant finding in such cases is vascular hypertension, in the course of which pathologic conditions may be found in the retina, in its blood vessels, or in both. The findings cannot be differentiated ophthalmoscopically from those of essential hypertension. Sooner or later failure of vision will bring the ophthalmologist into consultation and the condition should be considered wherever evidence of vascular disease is found. David O. Harrington.

Brun, J. **Early and late tuberculosis, including paraglandular.** Ann. d'ocul. **181**: 81-105, Feb., 1948.

In this outstanding contribution, 740 cases of ocular tuberculosis are analyzed according to their place in four categories.

Extraocular semiology. Primary infections before the age of 20 years are classed as youthful; after that age, adult. The initial signs of primary pulmonary-glandular infection are: recent exposure to contact; slight systemic toxemic reactions, not infrequently with local cutaneous and ocular phlyctenules; mediastinal adenopathy; strongly positive cuticular or other tuberculin reactions; positive tubercle inoculation from gastric contents. In the later stages of infantile and youthful infection, the more positive signs are persistent but apparently recent cervical and/or subclavicular adenopathy and recent idiopathic serofibrinous pleurisy. The less positive signs are enlarged pulmonary and/or subclavicular nodules, often fibrosed or calcified as determined radiologically, clinical symptoms of pleurisy, asthenia, loss of weight, fever, and transient involvement of the eyes, testicles, kidneys, and other organs. The early signs of primary pulmonary-glandular infection in adults and recurrences of primary infections in infancy and childhood are frequently similar. The more positive signs are persistent cervical or mediastinal adenopathy with or without suppuration, infiltrative lung lesions, recurrent or old, usually in the upper lobe, and various extrapulmonary lesions involving the eyes, especially deep keratitis and uveitis, viscera, skin and joints. The less positive signs include prolonged infectious contact, cervical or mediastinal calcified gland lesions radiologically determined, enlarged glands, especially apical and subclavicular, variable, but usually transient, local and serous reactions like pleurisy, synovitis, phlyctenulosis, deep keratitis, or uveitis, and strongly positive cuticular reactions, of greater importance in ages beyond 40 years. Recurrence of lesions is usually associated with increased immunity. The complete sequence of ocular involvements especially in youthful infections is phlyctenulosis,

deep keratitis or scleritis, uveitis, iritis, iridocyclitis, choroiditis.

Phlyctenular keratoconjunctivitis. 404 cases. This most frequent ocular manifestation of tuberculosis of which 404 cases were observed usually occurs before the age of 12 years and is essentially a local, serous, hypersensitive reaction. It occurs within one year of the primary infection in 80 percent of patients. In 94 percent of patients a strongly positive cuticular reaction usually develops several months before the onset of the phlyctenulosis which coexists with mediastinal adenopathy in 16 percent of the patients. There are recurrences in 50 percent which usually are accompanied by persistent strongly positive cuticular reactions. In 63 percent the history of tuberculous familial or parafamilial prolonged contact was obtained. Primary nasopharyngeal and tonsillar infection is especially frequent in the very young, with resulting early cervical adenitis. Phlyctenulosis may follow numerous infectious and metabolic diseases especially in children with or without an associated glandular tuberculosis. The most frequent sequel and complication of recurrent phlyctenulosis especially in youth is deep keratitis and scleritis which may be followed by uveitis. In adults phlyctenulosis is infrequent and usually there is coexistent mediastinal adenopathy.

Deep keratitis and scleritis. 138 cases. This group usually begins at a later age than phlyctenulosis, between the ages of 10 and 20 years in the younger group, and between 20 and 50 years in the older group. In younger persons these diseases follow primary infection by not less than six to nine months and often represent a sequel to one or more attacks of phlyctenulosis. They are also secondary to a persistent mediastinal and cervical adenopathy and in 15 percent were associated with pleurisy. In older persons they follow the primary infection usually by years and correspond somewhat to the early tertiary stages of syphilis. Familial and other probable sources of infection were reported in 50 percent and strongly positive cuticular reactions existed in 58 percent.

Uveitis. 198 cases. This group includes iritis, iridocyclitis, choroiditis, and retinal hemorrhages, singly or in combination. In the earlier stages of youthful infection, iritis, although the most frequent of the group, occurred in but 4 percent. Of the eight cases analyzed, extrapulmonary infectious processes existed in four and a strongly positive cuticular reaction in five. The usual sequences in youthful primary infection are phlyctenulosis, deep keratitis or scleritis, and uveitis. Of the 190 primary infections of adults, 152 were in the iris and other anterior uveal tissue. Uveal involvement in the older group usually began between the ages of 30 and 40 years. Evidences of past or present pleurisy existed in 25 percent of the iritis patients. Apical pulmonary nodules were observed in 40 percent. Collapse therapy was frequently followed by marked ocular improvement. The cuticular reaction was strongly positive in 52 percent. The respective ages, probable source of infection, extraocular evidences of tuberculosis, and cutaneous allergy are analyzed in detail for each uveal group.

Paraglandular ocular tuberclosis: In this section, the relationships of phlyctenulosis, deep keratitis, and scleritis, as well as the different forms of uveitis are analyzed from the standpoint of the pulmonary-glandular and other tuberculous processes such as mediastinal, apical, and cervical adenopathies, in their relationship to youthful and adult primary and secondary ocular involvements.

Therapeusis. The favorable ocular progress of tuberculous patients treated with calcium, gold salts, methylic antigen, and tuberculin, has frequently been so slight that one cannot but wonder

whether or not their use was justified. The treatment of enlarged tuberculous glands by radiotherapy is not new, but is now sufficiently understood to be more efficiently employed. Radiotherapy is contraindicated in very recent adenopathies, such as usually exist in early phlyctenulosis. It is indicated in the later stages and is without danger if employed with reasonable prudence. It reduces the infectiousness and toxicity of the glands through which most of the toxins reach the eye, but does not directly kill tubercle bacilli. Coincidental infections, especially staphylococcal and streptococcal, are not affected. Caseous glands should be evacuated before radiotherapy is begun. In cervical adenopathies, doses of 100 R are repeated every five days to form a series of five or six treatments. After a rest period of one month, the treatments may be repeated. Glandular retrogression usually begins within a month. The hygienic treatment of all tuberculous patients including those who have ocular involvements is the most important factor in tuberculous therapy. The author and most French writers on ocular tuberculosis insist upon the advantages of a high altitude, 4,500 feet or more above sea level. The successful treatment of ocular lesions is frequently complicated by secondary infections such as influenza and the infections of childhood. Ocular involvements usually signify tissue reactions to toxins transmitted to the eye through the lymph stream rather than hematogenous emboli. These lymphogenous toxins attack tissues which have been previously sensitized, injured, or which are constitutionally imperfect. Ocular involvements are therefore inversely proportionate quantitatively and qualitatively to pulmonary tuberculosis alone, because glandular infection and transmission is the dominant factor in ocular involvement.

The original article is but an abstract of a large monograph. Its thoroughness and understanding facilitate a better coordination of the clinical, pathological and etiological factors in the diagnosis and treatment of the ocular manifestations of tuberculosis. Chas. A. Bahn.

Goedbloed, J. **Capillary hemorrhages of the retina and capillary fragility.** Ophthalmologica **115**:174-179, March, 1948.

One patient with hypertensive cardiovascular disease and one with diabetes showed small retinal hemorrhages associated with a high Goethlin index. Under treatment with rutin the Goethlin index returned to normal and most of the retinal hemorrhages disappeared.

P. C. Kronfeld.

Hartmann, E., Collin, P., and Vergne, P. **Scleroderma and fundus lesions.** Ann. d'ocul. **181**:220-225, April, 1948.

Fundus lesions associated with scleroderma have until now not been recorded. Associated lens opacities, however, are not infrequent. In a woman, 57 years of age, with the classical structural and functional symptoms of generalized scleroderma, the following fundus picture was observed. Fifteen to 20 small gray-yellowish areas were irregularly arranged around the macula in both eyes. They were round or oval, and variable in size, averaging one-fourth disc diameter. Some were slightly pigmented, located in the deeper retinal layers and not associated with any vessels, and, in one eye, very faint deep radial lines were observed about the disc. Vision was normal as were the functions and structures of the orbit and its contents. The author apparently believes that the fundus condition is an unusual manifestation of the sclerodermal process which began in Bruch's membrane. The clinical picture suggests to me an atypical bilateral, progressive, presenile, perimacular, constitutional degenerative disease in a patient with another constitutional disease of the neuro-vascu-

lar type, scleroderma. Both have in common progressive mesodermal deterioration with imperfect repair. The differential diagnosis of the condition involves drusen as well as tapetoretinal, punctate, and vascular degenerative diseases of the retina. Chas. A. Bahn.

Hartmann, K. **Removal of a living cysticercus from the anterior chamber.** Klin. Monatsbl. f. Augenh. **112**:333-338, 1947.

Cysticercus invasion of the bulbus has now become a rarity. Invasion of the anterior chamber is much more infrequent than localization in deeper parts of the eye. A case is described which presented the picture of a severe iridocyclitis. Only after repeated puncture of the anterior chamber and removal of the dense serofibrinous exudate was the cysticercus discovered as the cause of the inflammation. The parasite was alive and was removed in toto after keratome incision. The eye recovered. The life cycle of the taenia solium is described and the literature surveyed. (References.)

Max Hirschfelder.

Meneely, J. K. **Fever of undetermined etiology associated with bronchopneumonia, conjunctivitis, stomatitis, and adenopathy (Stevens-Johnson syndrome).** New York State J. Med. **48**:1399-1400, June 15, 1948.

A febrile clinical complex of considerable severity and lesions in several systems of organs is described as seen in a 13-year-old girl. No causative organism was isolated. The author believes that his patient had a variant of the Stevens-Johnson syndrome. F. H. Haessler.

Much, V. **Eye findings after amebic dysentery and in ameba-carriers.** Ophthalmologica **114**:384-396, Dec., 1947.

In Tel Aviv amebic dysentery with and without definite gastrointestinal symptoms is apparently a common disease. The diagnosis of the latter form is based on stool examinations for ameba, on stool cultures and on the complement fixation test. Because of the many borderline cases that are seen in Palestine, the ophthalmologist has been asked to be alert for eye manifestations of amebiasis. The most important and apparently quite common eye-symptom is a partial gray discoloration of the disc which ordinarily would be suggestive of multiple sclerosis. Observation of these patients over a period of several years reveals no signs of nervous system involvement nor any appreciable loss of visual function. An ocular manifestation of the impaired liver function in amebiasis is an abnormal increase in the permeability of the blood-aqueous barrier as evidenced by a more rapid passage into the anterior chamber of fluorescein taken by mouth than is characteristic of normal control individuals. Peter C. Kronfeld.

Németh, L. **Ocular changes in tuberculous skin diseases.** Ophthalmologica **115**:167-173, March, 1948.

The eye findings in 36 patients suffering from various forms of tuberculosis of the skin are reported. Cicatricial ectropion, dacryocystitis and deep corneal scars were the more common manifestations of active or healed ocular tuberculosis. Eight patients showed involvement of the posterior segment in the form of choroiditis or chorioretinitis. The clinical picture and the course of the choroiditides varied a good deal. Striking are the noncharacteristic or even negative pulmonary findings. P. C. Kronfeld.

Redslob, E. **The problem of diabetic retinopathy.** Ann. d'ocul. **181**:129-135, March, 1948; **181**:224-243, April, 1948.

In some instances, insulin has apparently aggravated diabetic retinopathies. This may be due to impurities in the insulin, allergic reactions, or other factors. It is possible that in some persons insulin,

by increasing the fat content of the blood and tissues, may increase the tendency to lipid degeneration especially of the hemorrhagic type. Diabetic retinopathies are slightly more frequent since the use of insulin. It is therefore advisable to use the minimal dosage of insulin in patients who have rapidly progressive diabetic retinopathies, especially hemorrhagic. Diabetic retinopathies are less related to age than to the duration of the diabetic process. The amount of glycosuria and hyperglycemia is apparently not of major importance. The pathologic processes in diabetic retinopathies are not characteristic. The frequent, deep punctate hemorrhages, hyaline degeneration and circinate arrangement form a clinical picture which is not pathognomonic of diabetes. Arterial and arteriolar sclerosis is a frequently associated or a complicating condition. Ophthalmoscopically, the differential diagnosis may be difficult. The diabetic process may provoke atherosclerosis, hypertension and nephritis, especially intercapillary glomerulosclerosis. The last named apparently plays an important part in the progress of diabetic retinopathies. In compound diabetic and hypertensive retinopathies too rapid lowering of the blood sugar is not advisable because the blood sugar is usually inversely proportionate to the hypertension.

Chas. A. Bahn.

Ricca, Salvatore. **Two cases of solitary oriental button, of the prelacrimal region and on the lid.** Ann. di ottal. e clin ocul. **73**:115-125, Feb., 1947.

Two cases of oriental button (cutaneous leishmaniasis) are reported. In one patient the chronic ulcerative granuloma was in front of the lacrimal sac and simulated a fistulizing peridacryocystitis; in the other the lesion was on the upper lid. In both cases the Leishmania tropica was found in smears. The differential diagnosis is discussed. In each case two local injections of emetine hydrochloride (2 cc. of 1 percent and 2 percent solutions, respectively, at four and six day intervals) brought about rapid recovery with excellent cosmetic results.

Harry K. Messenger.

Shannon, C. E. G., and Hunt, W. **The hyperophthalmopathy of Graves' disease.** Tr. Am. Ophth. Soc. **45**:240-253, 1947.

Clinically hyperophthalmopathy is seen in the hyperthyroid, hypothryroid states and with a normally functioning thyroid and the type may vary in many ways. In the thyrotoxic state the exophthalmos is as much apparent as real, but it may be actual when the thyrotropic factor of the pituitary is excited.

Exophthalmos increases in 50 percent of cases after thyroidectomy. The pituitary secretion may sometimes be controlled by X-ray therapy. Where ocular symptoms are out of proportion to the thyrotoxicosis and in the presence of a low basal metabolic rate, thyroidectomy is contraindicated. The choice of treatment must be based on the morbid mechanism.

David O. Harrington.

19

CONGENITAL DEFORMITIES, HEREDITY

Biró, I. **Data concerning the heredity of astigmatism.** Ophthalmologica **115**:156-166, March, 1948.

The author had the opportunity of examining 31 members of one family representing three generations. The transmission of astigmatism seemed to follow a somewhat irregular but, in principle, dominant pattern.

P. C. Kronfeld.

Franceschetti, A. **Embryopathy from German measles in pregnancy.** Ann. di ottal. e clin. ocul. **73**:1-7, Jan., 1947.

Comment is made on three cases, in one of which there were numerous pigment spots of various sizes in the retina, espe-

cially at the posterior pole. To designate this fundus picture Franceschetti proposes the name of pseudo-retinitis pigmentosa. He also calls attention to a digito-ocular phenomenon, which he has observed in cases of congenital cataract and of amblyopia from microphthalmos and albinism, but which he has never met in cases where light perception is absent. The affected child spontaneously presses upon the eyes with the fingers and presumably produces phosphenes thereby. He has also noted an analogous digito-auricular phenomenon in one case. Illustrations are given of these phenomena, as well as of postrubeolic congenital cataract and of pseudo-retinitis pigmentosa. Harry K. Messenger.

Lloyd, R. F. **The clinical course of the eye complications of arachnodactylia.** Tran. Am. Ophth. Soc. **45**:342-354, 1947.

It is generally thought that the lens dislocations and rigid irides seen in archnodactylia are nonprogressive congenital defects. Observations on 43 cases has convinced the author that many are true abiotrophies. While some patients complain only of reduced visual acuity, many have progressive lens dislocation and a degeneration that ends in detachment of the retina.

The hereditary pattern and clinical development of the disease and its eye complications is discussed. Operative hazards are reviewed. Five families and six individual cases are presented.

David O. Harrington.

Patrick, P. R. **Report of a survey of children born in 1941 with reference to congenital abnormalities arising from maternal rubella.** M. J. Australia. 1:421-425, April, 1948.

A severe outbreak of German measles occurred in Queensland in 1940 after which a large increase in the number of children admitted to the school for the blind and deaf occurred. Many of the affected children were examined and 7,822 returned questionnaires are analyzed. The most frequent abnormality found was deafness; then followed congenital heart disease, mental deficiency and cataract. A pigmentary abnormality in the fundus of these "rubella" children was noted, but their vision was unaffected. The problems of treatment, education, and prevention are discussed. Orwyn H. Ellis.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Bailliart, P. **What should we conceal from and what should we tell our patients?** Ann. d'ocul. 181:304-306, May, 1948.

Only moral honesty and professional responsibility can determine what should be concealed from the patient. Numerous illustrations are presented. Conditions which may be incurable today may tomorrow become remediable. Those who make positive statements should be doubly sure and realize the accompanying responsibility. Even a death sentence may be pronounced in a merciful manner. Those who are probably very soon to be sightless should be given the opportunity of adjusting themselves through Braille and other facilities for the sightless. The risks of operations should be thoroughly understood by the patient. Only too often patients are misled concerning the risks of operations. A difficult problem involves the time factor in the adjustment to blindness. Is it better for the patient to know the whole truth quickly in order that the adjustment may be more rapid, or should he be allowed to realize the truth more slowly so that he may have more time for adjustment? Chas. A. Bahn.

Clark, W. B. **Ocular onchocerciasis in Guatemala. An investigation of 1,215 natives infected with Onchocerca vol-**

vulus. Tr. Am. Ophth. Soc. **45**:461-501, 1947.

The incidence of ocular onchocerciasis is still undetermined. Ocular manifestations were found in 44 percent of 1,215 patients with onchocerciasis or with a history of the disease and 0.43 percent of those with the ocular type of disease were blind or practically blind.

Unless the possibility of vitamin deficiencies, endocrine disturbances, focal infections, syphilis and tuberculosis are ruled out in persons with the disease all the ocular lesions found in patients with onchocerciasis cannot be attributed to the disease. Additional histopathologic studies are needed on the eyes of patients with onchocerciasis. The author considers that the characteristics of the fundal lesions suggest a degenerative rather than an inflammatory process. The possible methods of spread to the United States are discussed but this occurrence seems unlikely.

David O. Harrington.

Del Rio Cabana, J. L. **Appraisal of disability and compensation of industrial ocular injuries.** Arch. Soc. oftal hispano-am. **8**:368-394, April, 1948.

At present the estimate of disability in ocular injuries in Spain is determined solely on the basis of visual acuity and is classified as temporary, partial permanent, total permanent, and absolute permanent. The loss of one eye, with one good eye remaining is defined as partial permanent disability. Disability is total permanent when one eye is lost and the other eye has less than a 50 percent impairment. Loss of one eye, with more than a 50 percent impairment in the other is classified as absolute permanent disability. Del Rio Cabana suggests a definite scale of compensation, similar to the one used in this country, based on loss of visual acuity, changes in the visual fields, disturbances in ocular motility, injury to the ocular adnexa, and factors which modify evaluation such as malingering or failure to use protective measures. The estimation of the impairment in these various functions is discussed in detail, and a compensation scale is presented. (6 figures.) Ray K. Daily.

Flowers, W. S. **Causes of blindness in China.** Chinese M. J. **66**:38-46, Jan., 1948.

Blindness in China is caused by smallpox, trachoma, ophthalmia neonatorum, phlyctenular conjunctivitis, keratomalacia, ulcerative keratitis and muco-purulent conjunctivitis. Irwin E. Gaynon.

Gözcü, Niyazi. **Certain considerations on blindness in Turkey.** Göz Kliniği **6**:1-5, 1948.

The positive results of the antitrachoma campaign which has been carried on in southern and southeastern Turkey since 1925 can be seen in a definite decrease of blindness rather than a decrease in the incidence of trachoma. The author compared the official statistical data of the trachoma campaign with those on blindness in the 1935 census. F. H. Haessler.

Imus, H. A. **Visual examination of flyers returned from combat.** J. Aviation Med. **19**:62-93, April, 1948.

Two hundred and fifty naval aviators were given complete eye examinations upon their return from combat. The men who had been selected because of their superior visual capacity had retained it.

Irwin E. Gaynon.

Marisco, Vincenzo. **The battle against trachoma.** Boll. d'ocul. **26**:710-715, Nov., 1947.

In the Lucania area of Italy, an apparent diminution of the number of trachomatous patients was due to the improvement that followed treatment with sulfa drugs. The number of infected families, and therefore the number of infectious foci, remained equal over the period 1940

to 1946. A comprehensive table shows the distribution of patients and of their complications. K. W. Ascher.

Pereyra, Georgia. **The eyes of men of genius and historical personages.** Giorn. ital. di oftal. 1:73-83, Jan.-Feb., 1948.

This paper, read before the Lay Medical Society of Florence, discusses briefly the eyes and ocular afflictions of many well-known men of the past, starting with Homer and including Adolph Hitler.

Francis P. Guida.

Sorsby, A., and Bishop, W. H. **A portrait of Richard Banister.** Brit. J. Ophth. 32:362-366, June, 1948.

The authors present evidence to show that a certain painting in possession of the Royal College of Surgeons is really that of Richard Banister, one of England's early ophthalmologists. In his writings he gave the first account of hardness of the eye as a diagnostic and prognostic sign. Orwyn H. Ellis.

HISTORICAL MINIATURES

St. Yves gave the first satisfactory description of glaucoma in 1722. His predecessors could not bring themselves to discard the Hippocratic word "glaucosis," although this word was used by the ancients for any incurable clouding of the pupillary area. St. Yves, on the other hand, referred to glaucoma as one of the false cataracts and described a clinical picture of which pain, dilated pupil, loss of visual acuity and field, and finally loss of transparency of the lens were parts.

Hirschberg, *Graefe-Saemisch Handbuch.*

The diagrammatic cross section of the eye that appears in the famous *Anatomy* of Vesalius, published in 1543, makes it clear that even then the true position of the lens was not understood. The Hellenistic-Arabic conception of the tremendous depth of the anterior chamber is the basis for the then-current belief that the couching needle, after it had penetrated the cornea, entered a huge space in which it could move in great arcs in all directions without touching the lens.

Hirschberg, *Graefe-Saemisch Handbuch.*

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
601 Union Trust Building, Cincinnati 2
News items should reach the editor by the 12th of the month

DEATHS

Dr. Roy M. Armstrong, Franklin, Kentucky, died May 3, 1948, aged 64 years.

Dr. Albert Stewart Barr, Ann Arbor, Michigan, died April 27, 1948, aged 65 years.

Dr. William Robert Morrison, Billings, Montana, died May 2, 1948, aged 72 years.

MISCELLANEOUS

ARMY RESIDENT TRAINING PROGRAM

A limited number of senior residencies in ophthalmology and a substantial number of assistant residencies in ophthalmology in Army general hospitals are available for newly commissioned officers under the military resident training program.

Under this program, any physician who qualifies for and accepts a commission in the Regular Army Medical Corps will be given the opportunity of competing for an approved residency in the field of his choice.

Applications for these residencies are currently being received in the Office of the Surgeon General.

HONOR SIR JOHN PARSONS

In honor of the 80th birthday of Sir John Parsons, his colleagues and friends presented to him his portrait painted by John Gilroy. The presentation was made on the afternoon of September 3rd in the library of the Royal College of Surgeons, Lincoln's Inn Fields, London.

FRANCIS I. PROCTOR LECTURE

On Friday evening, September 10, Dr. David G. Cogan of the Harvard University Medical School, Boston, delivered the third Francis I. Proctor Lecture on Ophthalmology at Toland Hall, University of California Medical School, San Francisco. The subject of Dr. Cogan's address was: "The Physio-Pathologic Basis for Some of the Signs and Symptoms of Corneal Disease."

ANISEIKONIC CLINIC

An aniseikonic clinic has recently been established in the eye department of the George Washington University Hospital, Washington, D.C. Facilities are available for the patient to have the frames measured and fitted in the hospital. The iseikonic lenses will be made according to prescription at the Southbridge plant of the American Optical Company. Dr. Ernest Sheppard, professor of ophthalmology, is the director of the clinic.

The patients are seen by appointment only. Arrangements for appointment can be made by writing to Miss Margaret W. Boudren, secretary, eye department, The George Washington University Hospital, 901 23rd Street, N.W., Washington 7, D.C.

WANTED: CASE REPORTS

If any ophthalmologist has had occasion to see a closure of the central retinal artery first recognized shortly after the patient came out of a general anesthetic will he be so kind as to convey the details of the case or cases observed to Dr. I. Givner, 108 East 66th Street, New York 21, New York. Please note which eye was affected, type of anesthesia used, length of the operation and its nature, whether or not the patient went into shock at the time of the operation, and if there were any evidences of the eye having been pressed upon during the anesthesia such as corneal abrasion, ecchymosis of the lids, and so forth.

DE SCHWEINITZ LECTURE

The 11th annual de Schweinitz Lecture sponsored by the Section of Ophthalmology of the College of Physicians of Philadelphia will be delivered by Dr. William L. Benedict on November 18th on the "Surgical Treatment of Tumors and Cysts of the Orbit."

UNIVERSITY OF GLASGOW LECTURES

During October a series of lectures are being given in the department of ophthalmology, University of Glasgow. The meetings, open to all medical practitioners and senior students interested in ophthalmology, are held at 8 o'clock each Wednesday evening. Tea is served after the paper and a discussion follows. On October 6th, Mr. Frank W. Law spoke on "Physiotherapy of the Eye." Dr. Paul Bacsich discussed "Experimental Corneal Grafting" on October 13th. "Plastic Surgery of the Eyelids" will be the subject presented by Dr. Byron Smith on October 20th, and Professor Loewenstein will speak on "Histopathology of the Drainage Angle" on October 27th.

SOCIETIES

WEST VIRGINIA MEETING

The fall meeting of the West Virginia Academy of Ophthalmology and Otolaryngology was held at the Greenbrier, White Sulphur Springs, September 20th and 21st. Dr. James A. Moore, New York, spoke on "Endaural Surgery in the Modified Radical and Radical Mastoidectomies," and Dr. Oscar B. Nugent, Chicago, on "Management of Strabismus."

ROUMANIAN SOCIETIES ORGANIZED

Word has been received that two new ophthalmic societies have been established in Roumania. The first of these is a clinical society, the Roumanian Society of Oculists, and is located at Timisoara.

Dr. Nicolas Blatt is president and Dr. Nicolas Zolog, secretary general.

The second, the Roumanian Society for the Prevention of Blindness, is also located at Timisoara. The president is Dr. Nicolas Blatt and the secretary general, Dr. Virgil Popovici.

SOUTHERN MEDICAL MEETING

The ophthalmic program for the Section on Ophthalmology and Otolaryngology to be held in Miami at the annual meeting of the Southern Medical Association is:

Monday, October 25th

1. "Sympathetic Ophthalmia," Dr. Sam McPherson, Durham, North Carolina.
2. "Iridencleisis," Dr. E. G. Gill, Roanoke, Virginia.
3. "The Use of Erisophake in Cataract Extraction," Dr. E. R. Veirs, Temple, Texas.
4. "Keratitis Nummularis (Dimmer): A Report of Five Cases," Dr. Stacy Howell, Atlanta, Georgia, and Dr. Curtis Benton, Jr., Fort Lauderdale, Florida.
5. "Vertical Phorias," Dr. J. L. Berg, Albany, Georgia.

Wednesday, October 27th

1. "Selections of Operations for Glaucoma," Dr. Conrad Berens, New York.
2. Chairman's Address: "Malignant Melanoma of the Iris," Dr. Shaler Richardson, Jacksonville, Florida.
3. "The Management of Convergent Strabismus," Dr. Frank Costenbader, Washington, D.C.
4. "Cataract Surgery," Dr. Mason Baird, Atlanta, Georgia.
5. "Complications of Glaucoma Surgery," Dr. P. M. Lewis, Memphis, Tennessee.
6. "Sodium Pentothal in Elective Eye Surgery," Dr. William M. Boles, New Orleans, Louisiana.

MILWAUKEE MEETING

The Milwaukee Oto-Ophthalmic Society held a joint luncheon meeting with the E.E.N.T. section of the Wisconsin State Medical Society on October 6th for its honorary members, Dr. Frederick A. Davis and Dr. A. D. Prangen. Dr. Davis presented a paper and motion picture on "Cataract Extraction."

CENTRAL ILLINOIS SOCIETY TO MEET

The next meeting of the Central Illinois Society of Ophthalmology and Otolaryngology will be held at the Abraham Lincoln Hotel, Springfield, Illinois, on November 13th and 14th.

Dr. F. Bruce Fralick, professor of ophthalmology, University of Michigan will speak on "Surgical Anatomy of Operations for Glaucoma," and will illustrate his lecture with moving pictures. Dr. Francis L. Lederer, professor of otolaryngology, University of Illinois, will discuss "Modern Approaches to the Prevention and Treatment of Defective Hearing." Dr. Roth, Belleville, Illinois, will present a paper on the "O'Connor Cinch Operation," and Dr. Judd, Kankakee, Illinois, will talk on "Malignancies of the Paranasal Sinuses."

PERSONALS

ILLINOIS FACULTY PROMOTIONS

Dr. Georgiana D. Theobald has been promoted to associate professor of ophthalmology at the University of Illinois College of Medicine, and Dr. Joseph S. Haas has been given the rank of assistant professor of ophthalmology.

ATTENDS HAWAIIAN MEETING

Dr. Arthur J. Bedell, Albany, New York, attended the meeting of the Pan-Pacific Surgical Association in Honolulu, Hawaii, August 30th to September 13th, at which he presented a series of three lectures.

ERRATUM

The Journal regrets that in the paper, "Senile Macular Lesions," by Dr. Ralph I. Lloyd, appearing in the September, 1948, issue, credit was not given to Dr. Bonaccolto for Figure 4 on page 1138 and to Dr. Dunnington for Figure 6 on page 1139.